15 DECEMBER 1955 ONE SHILLING

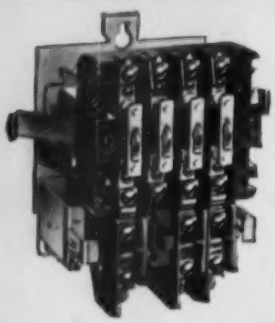
ELECTRICAL TIMES

You can standardise on motor starters with MEM 'Autoline'

When a new motor comes in you're never stuck for a starter if you keep a few MEM "AUTOLINES" in stock. The big advantage of the "AUTOLINE" is that it will provide overload precision protection for all motors rated between ¼ h.p. and 15 h.p.

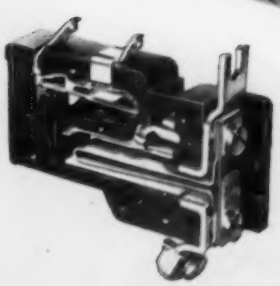
The heaters are the only variable component involved and these can be selected from a range of 40 heaters to ensure precision protection for any motor up to 15 h.p. (25 amps. max.).

The MEM "AUTOLINE" is built to an advanced design produced by one of Britain's leading specialists in motor control gear. It has extra safety clearances and is substantially made in every detail.



The Skeleton Pattern Units can be combined in various ways to meet a wide variety of different needs on machine tool applications.

Any MEM "AUTOLINE" starter can be changed from Automatic to Manual resetting operation in a few moments. A cover with "Reset" Button only is available.

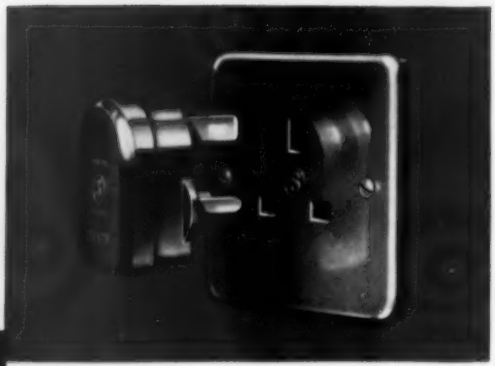


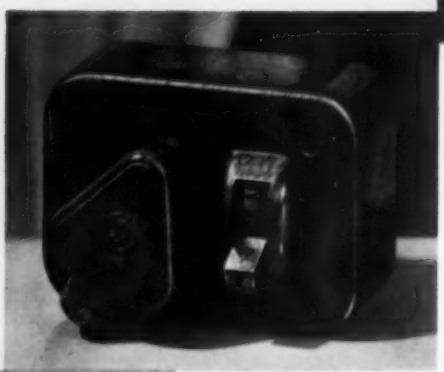
Exclusive new overload relay design with heaters specially designed for each rating means accurate protection under all conditions.

The contacts are of solid silver. You will find contact replacement is especially simple. You just flick over a spring catch and lift off.

MEM MIDLAND ELECTRIC MANUFACTURING CO. LTD., TYSELEY, BIRMINGHAM, 11

ACCESSORIES
for Better installations!





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★ Every SANDERS product is the leader in its own particular field, backed by 60 years experience.

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UNBREAKABLE PLUG

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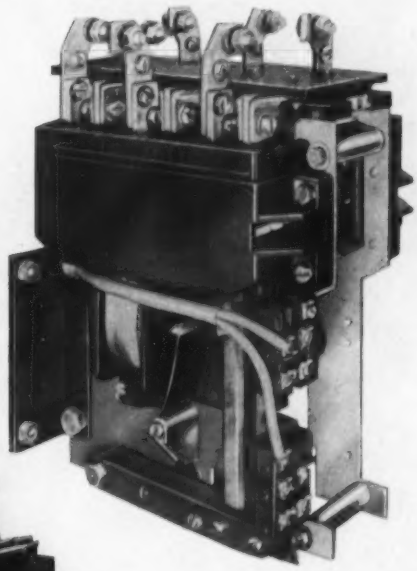

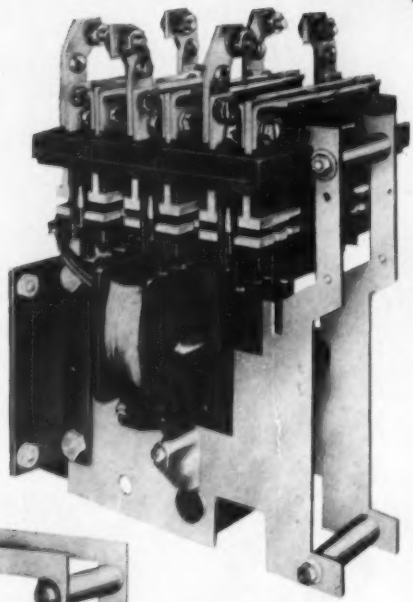

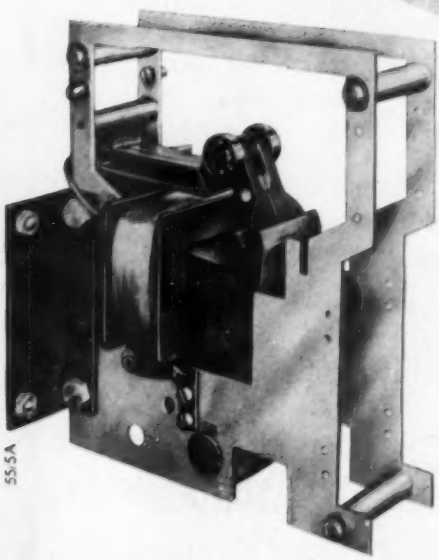

TECHNICAL DATA

3 phase - 400/440/500 volts - 50 cycles	
Continuous rating	160 amperes
Starter rating	65 HP squirrel cage 110 HP slipring motor
Maximum rate	1800 operations an hour
Mechanical life	10 million operations
Electrical life	30 HP - 10 million operations 65 HP - 3 million operations 110 HP - 1,8 million operations

Without replacement of contacts!

The insulation is laid out to comply with international standards for industrial switchgear up to 600 volts.

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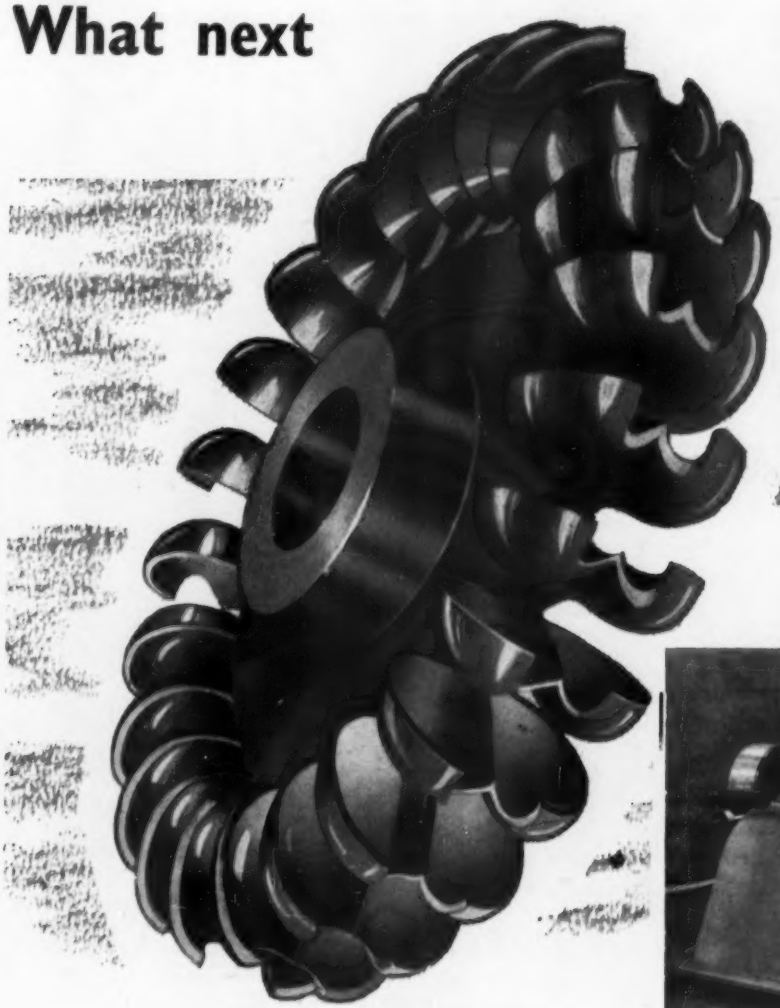

The runner and other castings have been made by Birkett, Billington and Newton for this 750 H.P. Pelton Wheel Generator supplied to the New Zealand Government by Gilbert Gilkes and Gordon Ltd., of Kendal.

Casting this water turbine runner in a single piece from aluminium-bronze was a considerable achievement. Birkett, Billington & Newton were able to tackle the job because they have specialised in the development of this metal, and their unrivalled experience and facilities enable them to carry out such problematic non-ferrous castings. Aluminium-bronze has a high yield point and a low weight/strength ratio, and is very resistant to shock, erosion, corrosion and abrasion.

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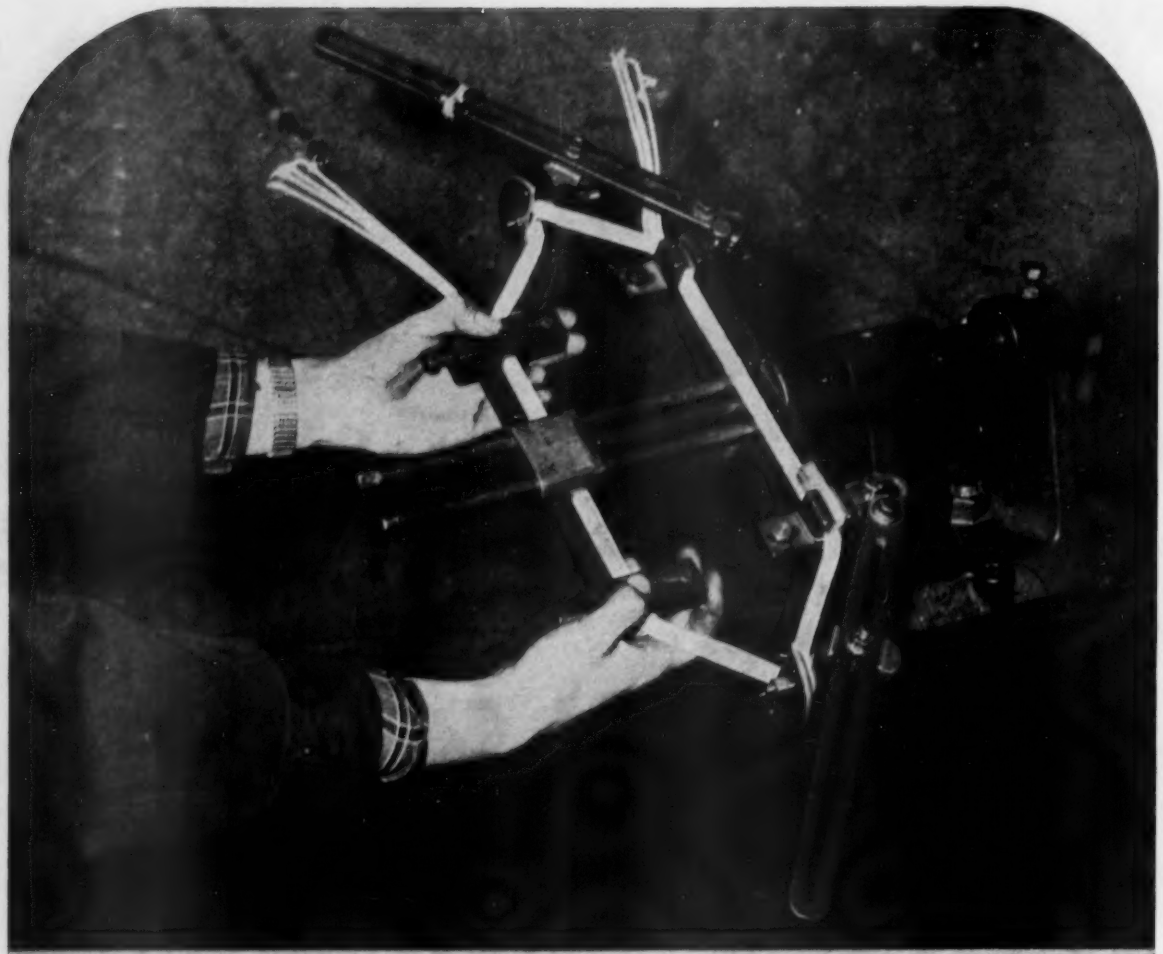

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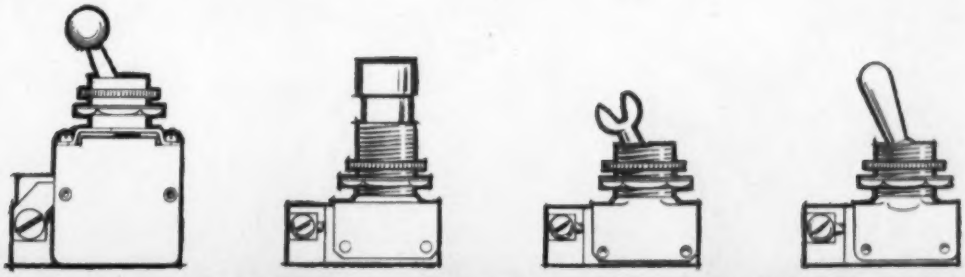
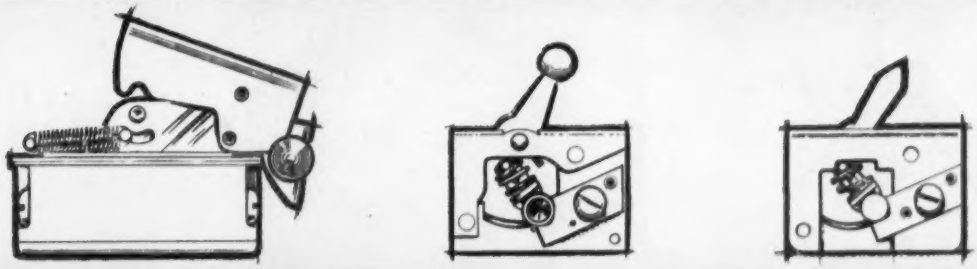
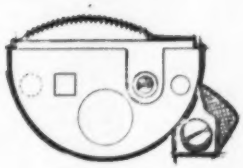
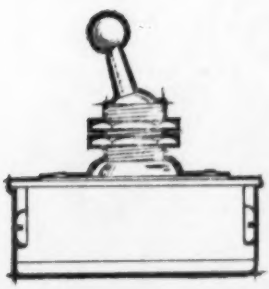


APPLIANCE



SWITCHES by





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warmest greetings for Christmas and
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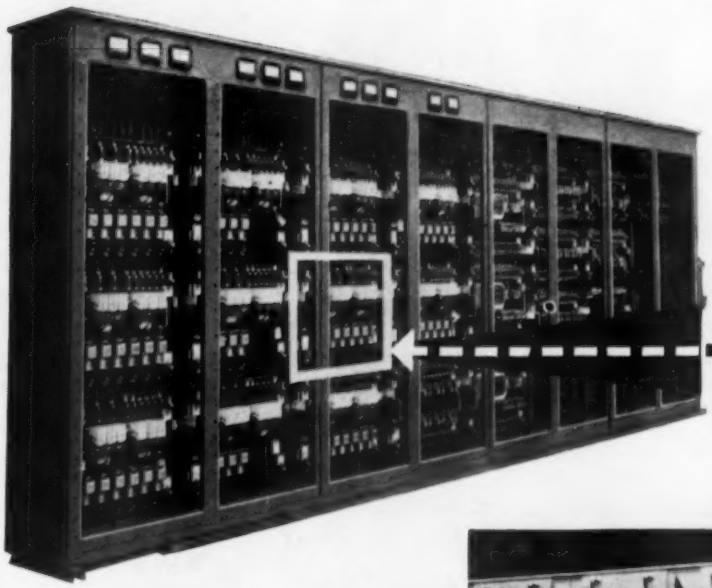
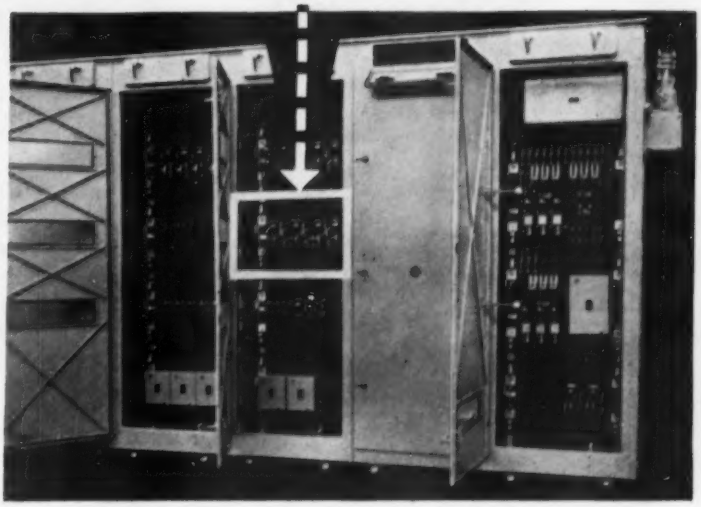


Individual control panels can be withdrawn in a few moments. This permits replacement (or maintenance) of any panel with MINIMUM DISTURBANCE to production



Above: One of the Switchboards installed in the new Car Assembly Building. The sequence of operations of the extensive conveyor system is controlled throughout by Switchboards of Donovan manufacture.

Right: Automatic Control Panel on body paint line.

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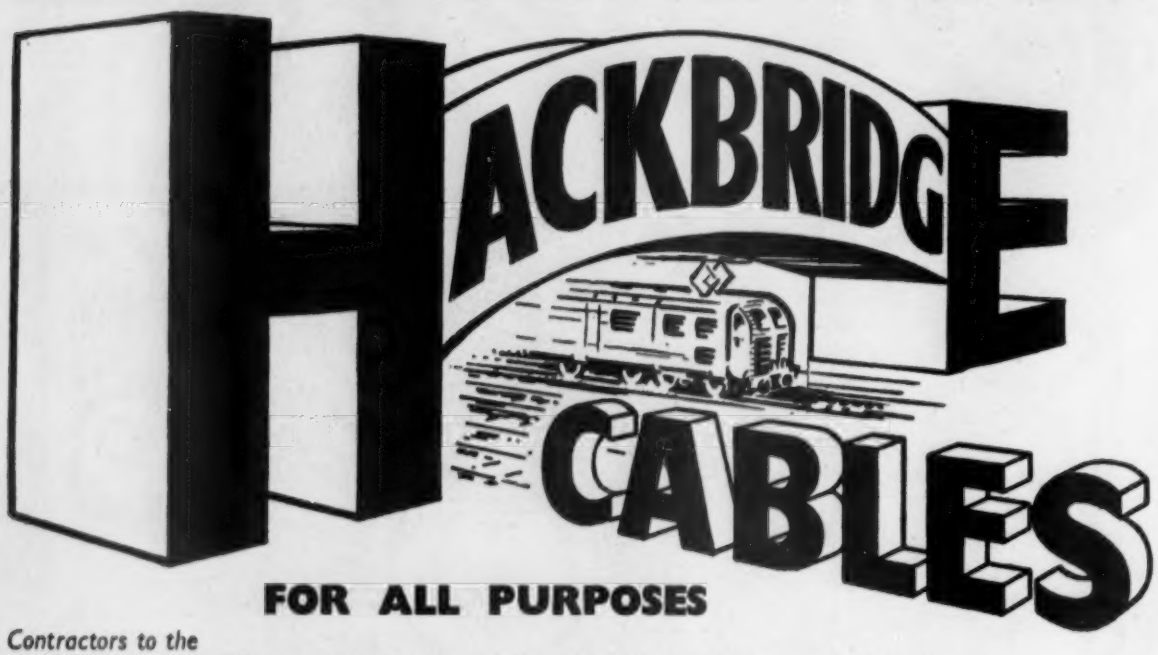

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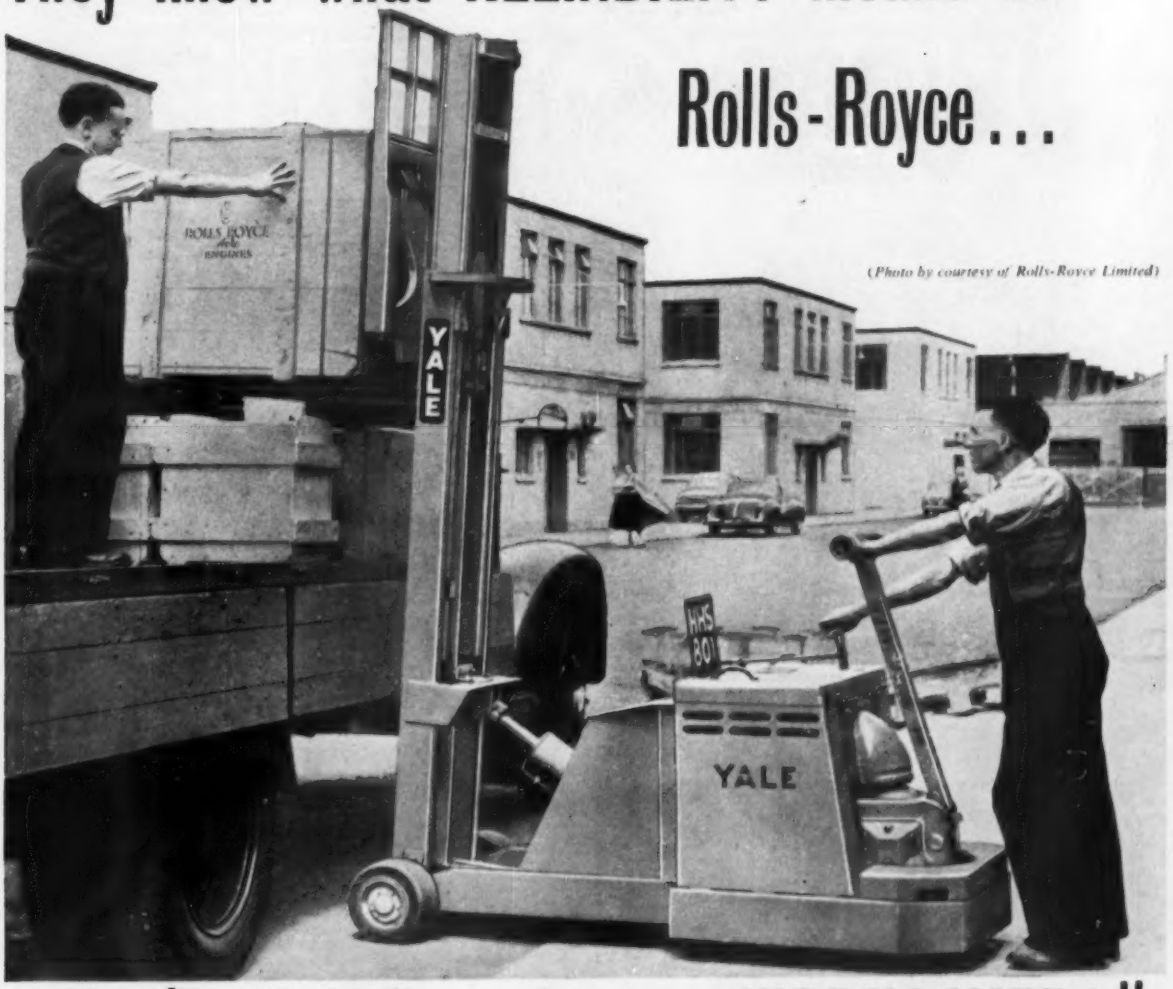

(Photo by courtesy of Rolls-Royce Limited)

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- **Low initial and running costs**
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Reliability is a quality they understand at Rolls-Royce. That's why they entrust the loading of these aero engine parts and other valuable products to YALE Worksavers — the trucks designed against breakdowns. Compact and robust, Worksavers economically carry and stack loads up to 3,000 lbs. They can work in confined spaces, and over low-load floors, and can safely be taken to upper floors by lift. *Please write for full details: we will gladly arrange a demonstration at your works.*

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YALE & TOWNE make the world's largest, most comprehensive range of materials handling equipment – including 1000 lbs. to 100,000 lbs. capacity power trucks.

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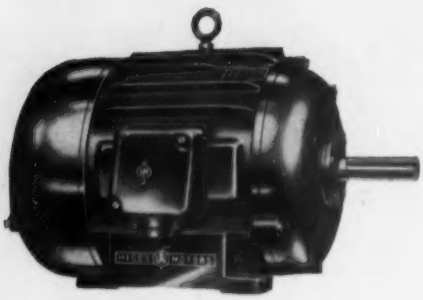

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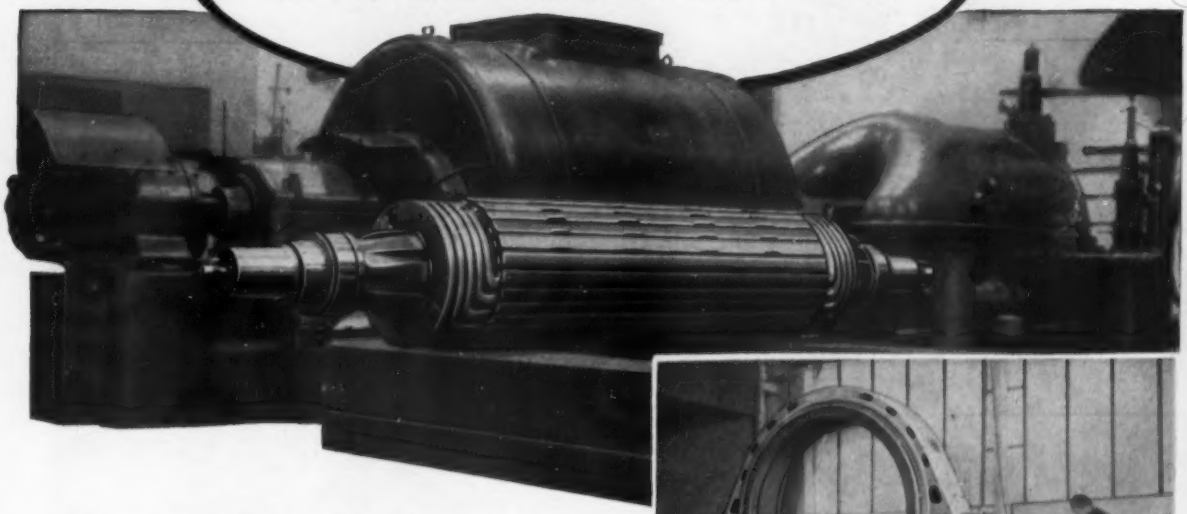
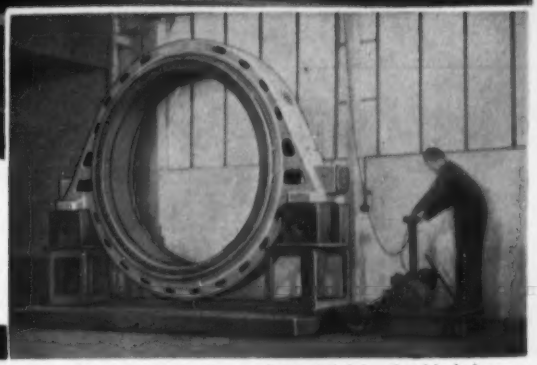


In electrical troubles, think of B.E.R.L.
Our nearest District Manager will give you personal attention, backed by the substantial resources of this nation-wide organisation.



12-ton winder motor stator, after complete rewind, being placed in drying oven on 20-ton capacity power-operated oven bogey.

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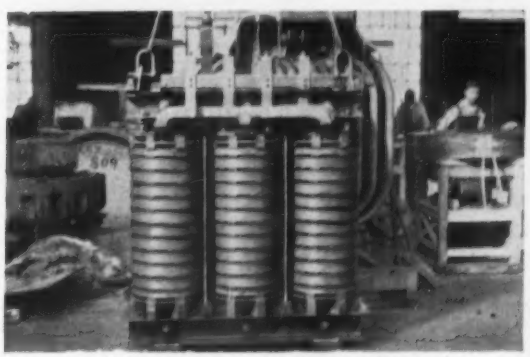
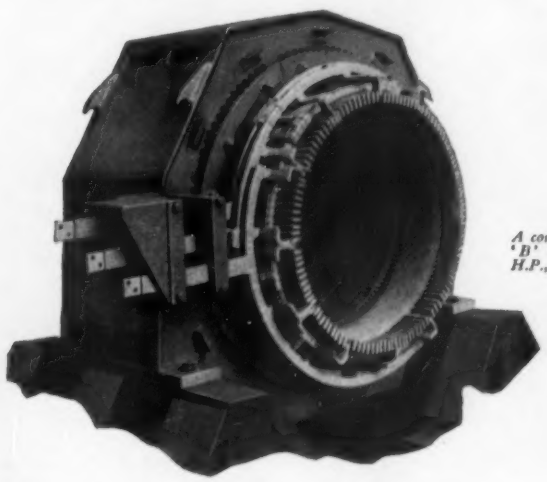


750 kVA Transformer, 20,000/440 volt, 3 ph., 50 cycle. (440 V Secondary rewound.)



A complete rewind with class 'B' insulation on a 1450 H.P., 550 V Motor Stator.

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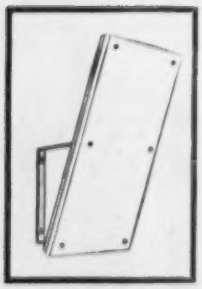
New high temperature panels

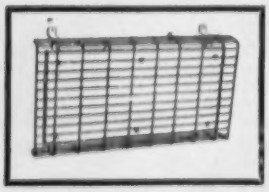
EKCO THERMOVENT

HIGH TEMPERATURE PANEL HEATERS

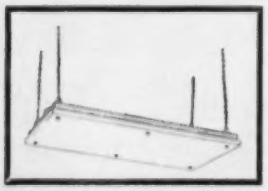
Where high heat-losses or rapid air-change make ordinary convection heating difficult, the Ekco Thermovent High Temperature Panel Heater provides the answer. And a very flexible answer it is. With the four simple fixings now available, hard to heat places in offices, factories and workshops present no difficulties. Efficient, safe and economical, the Panel consists of a steel tray housing a high-grade nickel-chrome element, with fibreglass insulation to reduce back-radiation. Front radiation plate is in cream vitreous enamel, other parts light hammertone bronze. Design includes a substantial and accessible Terminal Box. Panels are available in two sizes, 12″ x 12″, 625 Watts and 24″ x 12″, 1,250 Watts.



New, simpler fixing with one-piece brackets.



Guards with strong four-point fixing are available, only for low level installations.



Suspension types are provided with Bracket Hooks and can be suspended on chains about 9/12 feet from the floor.

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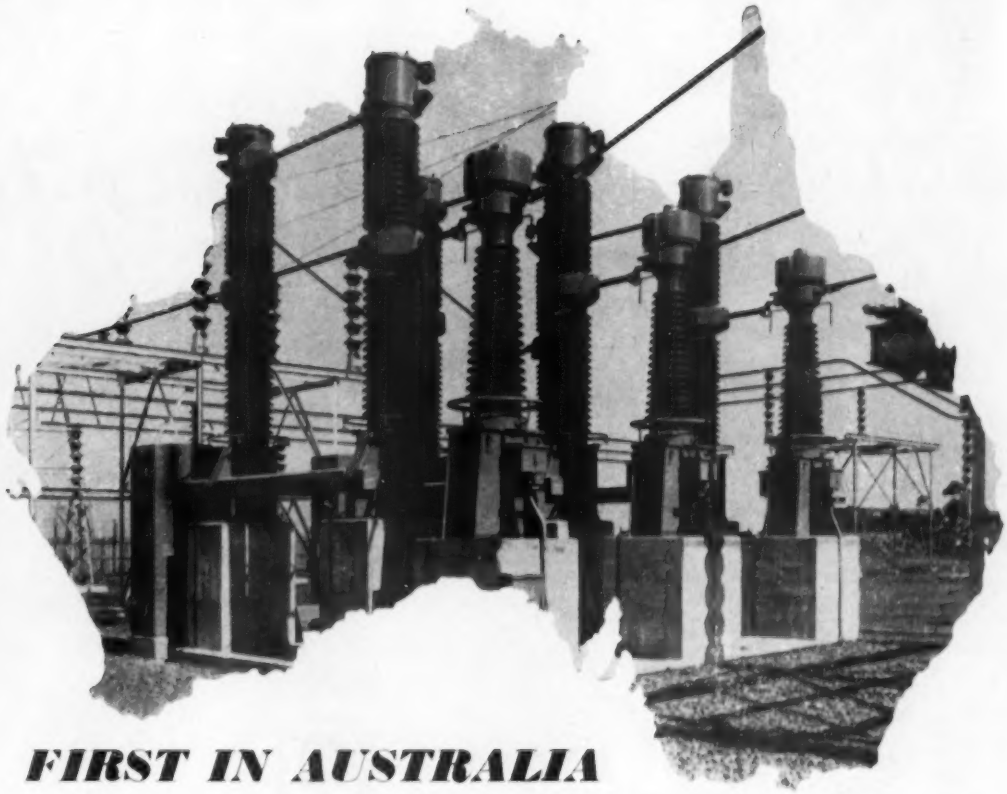

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A New Development

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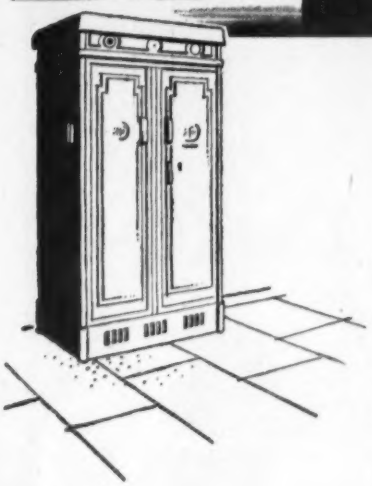

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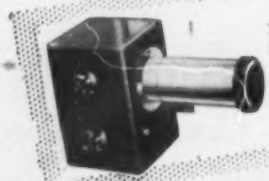

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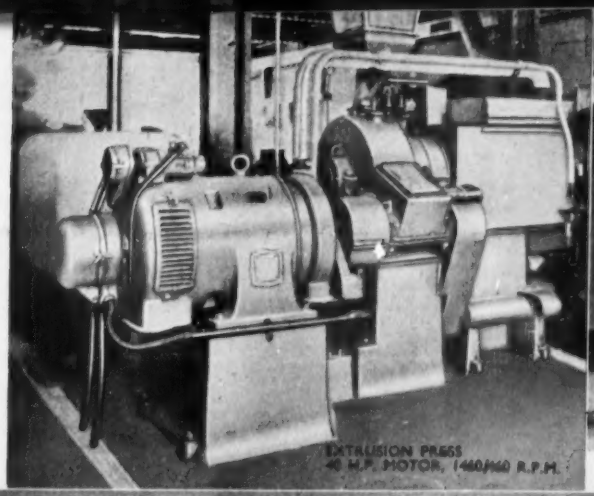
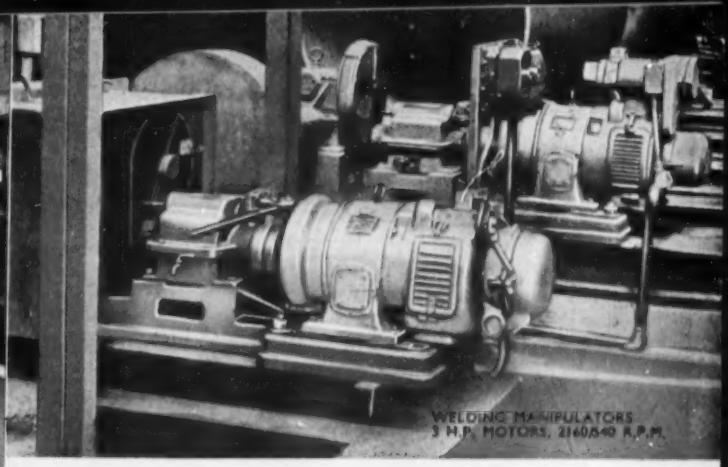
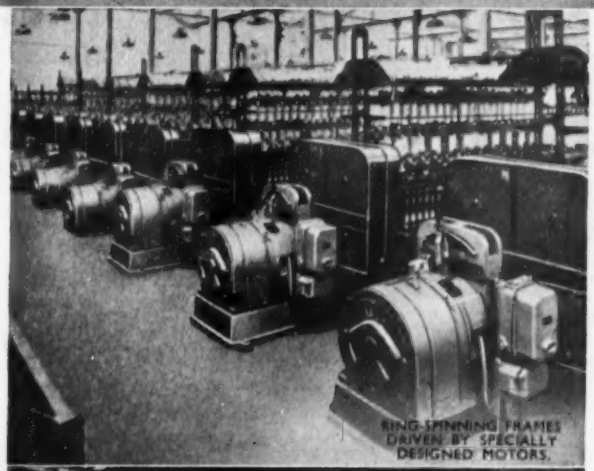


EXTRUSION PRESS
40 H.P. MOTOR, 1440/960 R.P.M.



WELDING MANIPULATORS
3 H.P. MOTORS, 2160/840 R.P.M.

3-PHASE COMMUTATOR MOTORS



RING-SPINNING FRAMES
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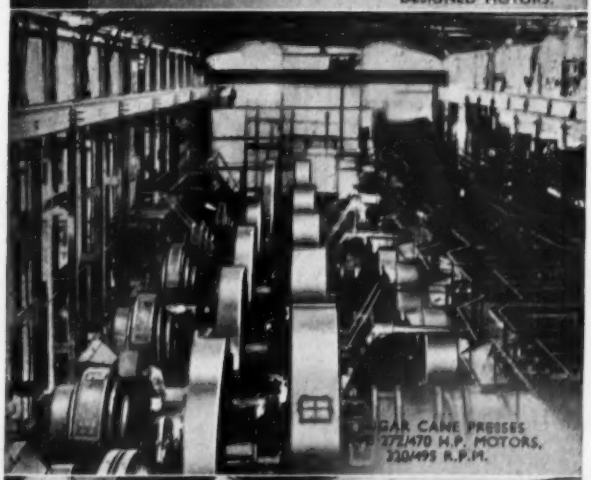
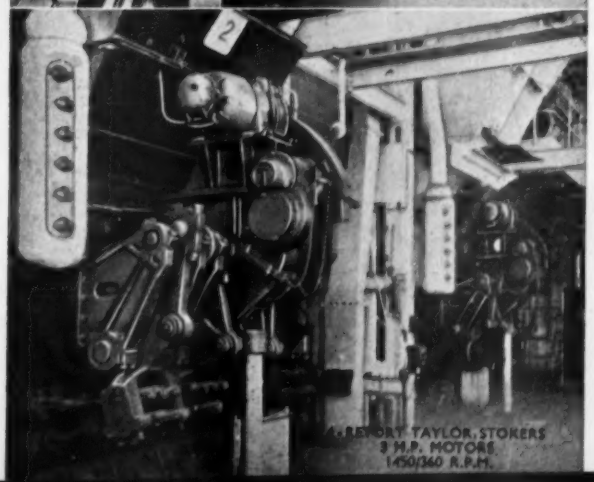


SUGAR CANE PRESSES
272/470 H.P. MOTORS,
220/495 R.P.M.



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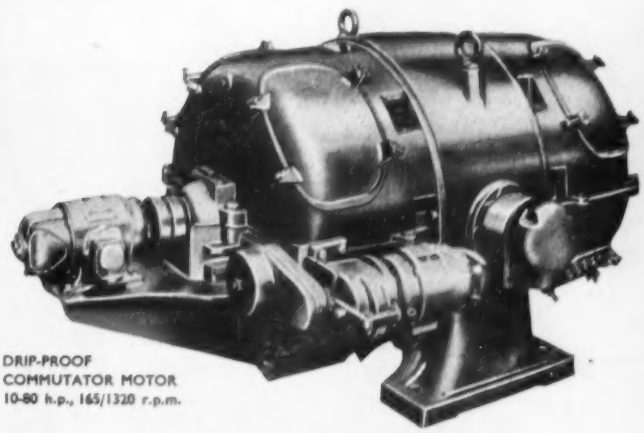
Send for literature today to tell you more of the benefits to be obtained by using these motors.

Prompt delivery of certain sizes can now be offered.



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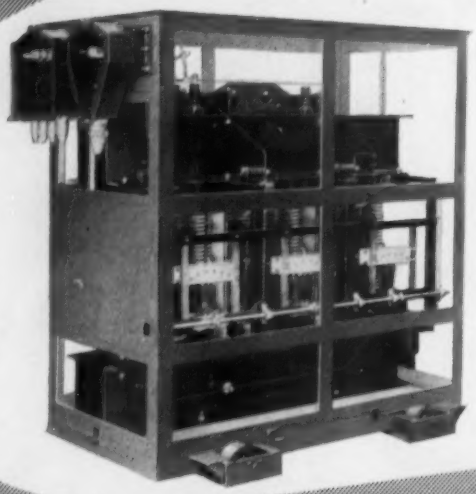

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CLASS H TRANSFORMER

The Backbone of Class 'H' insulation...

The insulating properties of Fibreglass are already widely applied in the electrical industry. Fibreglass is also combined with silicone compounds : chemical hybrids which possess much of the heat stability, inertness and electrical non-conductivity of glass-fibre. The result is Class H insulation, the basis of the revolutionary new dry type transformers.

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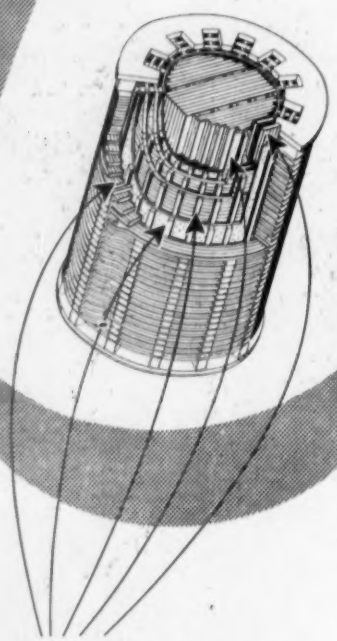
2. **Less weight — 15% less than Class B.**
3. **More frequent overloads permissible because of greater thermal conductivity and heat stability.**
4. **Can be installed in damp or dusty locations.**
5. **Less maintenance because no space heaters required.**
6. **Resistance to corona.**



Where does Fibreglass play its vital role? Here, here . . . and here

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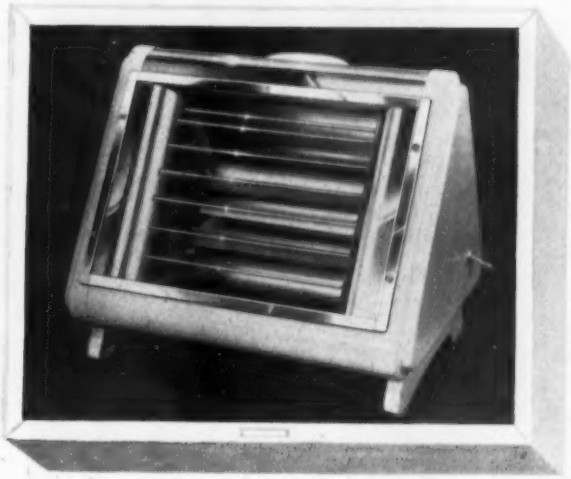

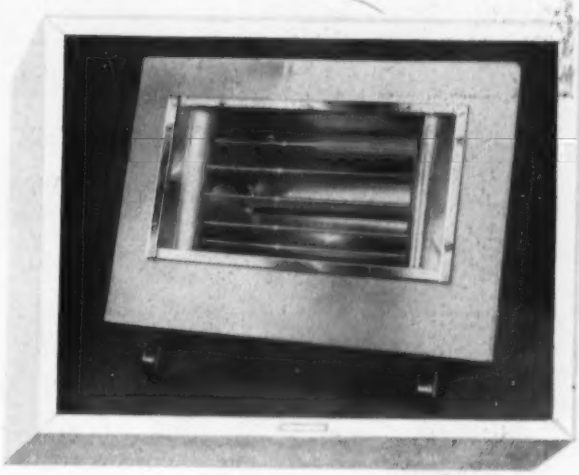

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(*Top Showcase*) **Heatrae "Dandy" Electric Fire** — radiates glowing warmth in complete safety: full-on consumption 2 units per hour, adjustable to one.

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(*Lower Showcase*) **Heatrae "Pilot" Portable** — the finest electric fire produced for occasional use — consumes only one unit per hour to give cheerful warmth. It has a cool lifting handle and is beautifully finished in Ivory Tan.

For full details of both the "Dandy" and the "Pilot" ask us to send you copies of our **Leaflet No. 68/C.** (*Both Fires are guarded to conform to BSS. 1945*)

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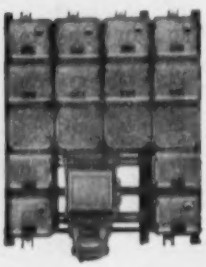
Featuring CORE BALANCE EARTH LEAKAGE PROTECTION

A triple pole 30 amp. Circuit Breaker with core balance transformer and E.L. relay



A typical multi-way 15 amp. board with instruments. Individual panel isolators also available.

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Refer to Page 22 "Electrical Accidents and other causes 1952" M o L Form 929

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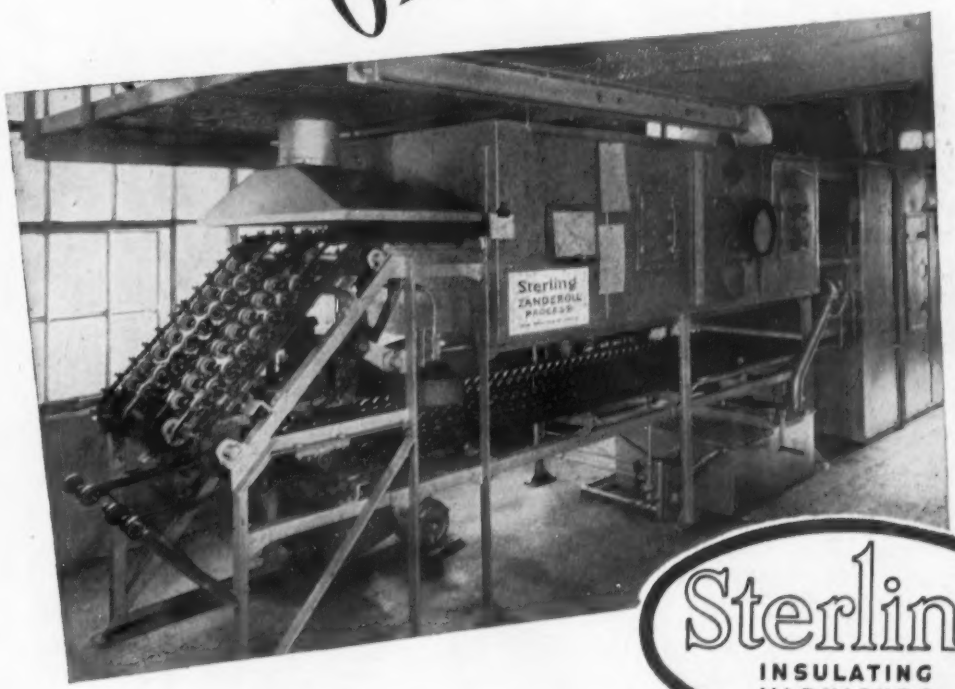

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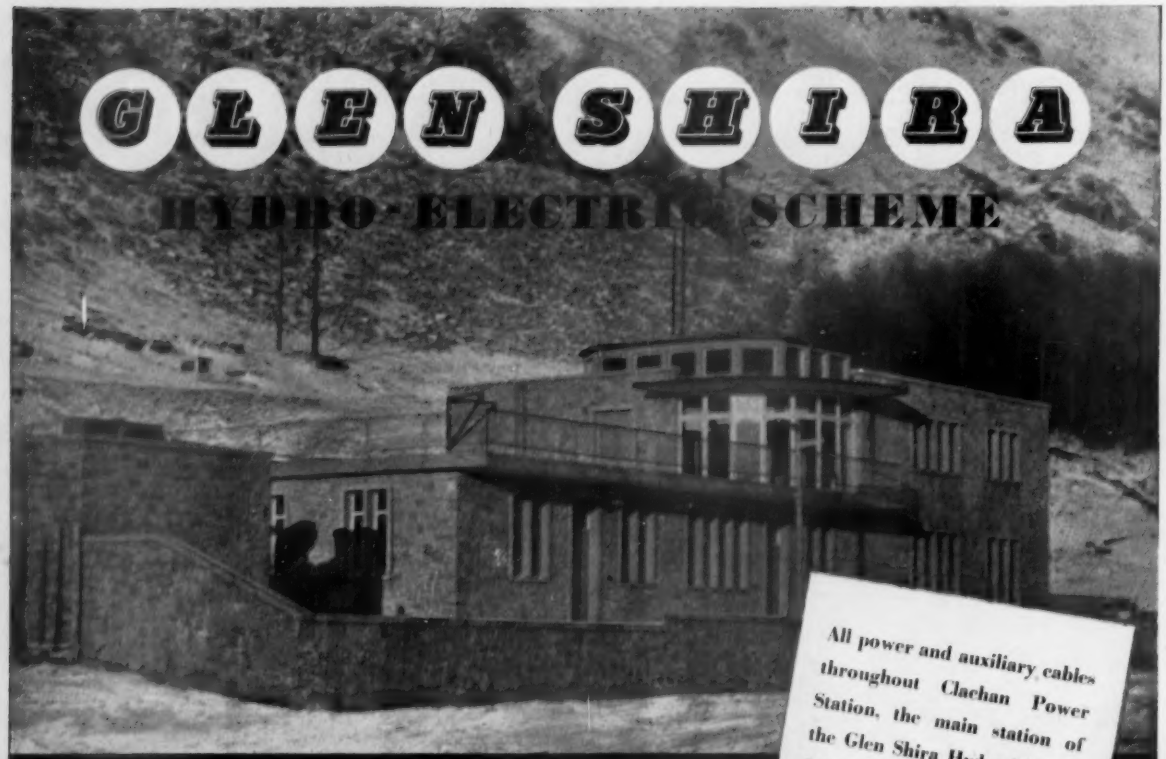

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50 MVA TRANSFORMER

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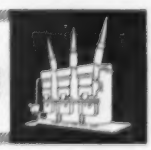

In association with The British Electric Transformer Co. Ltd.

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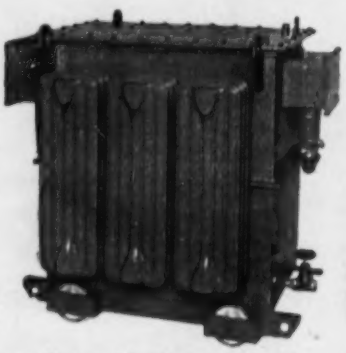

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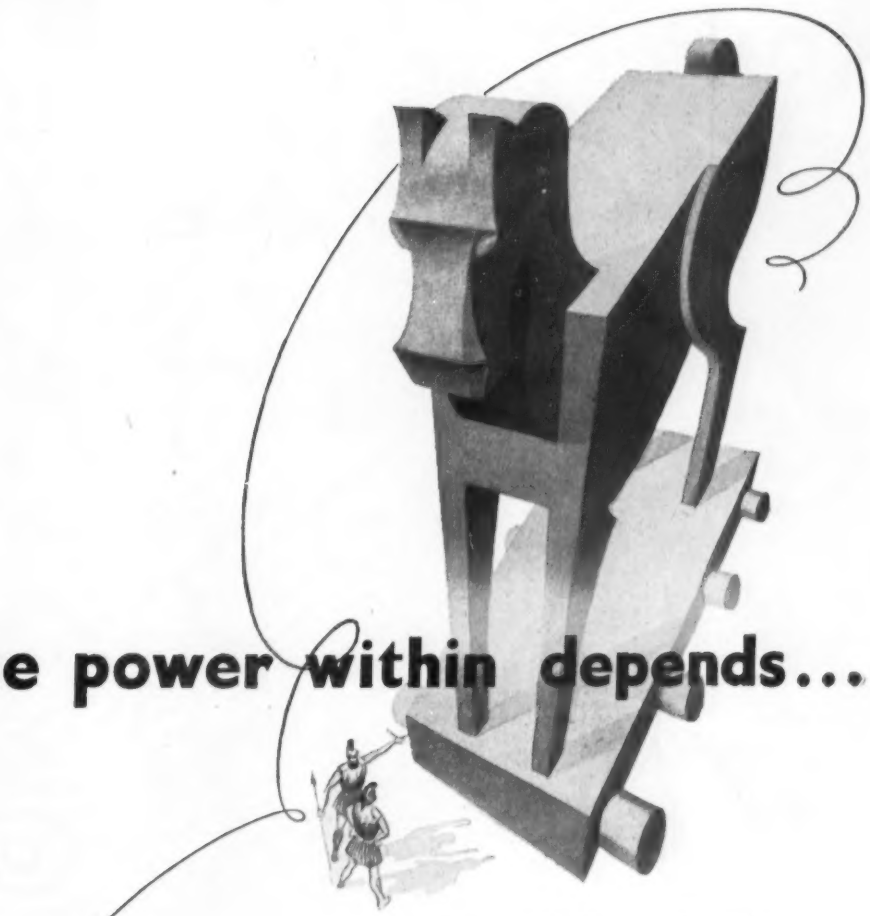

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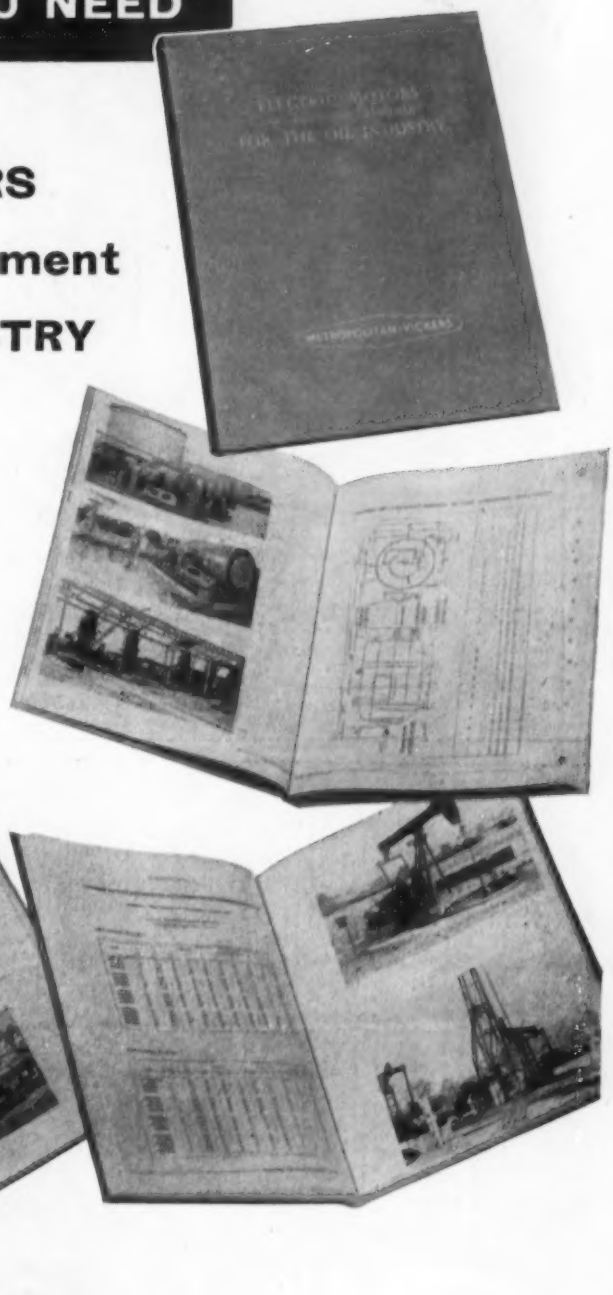
ELECTRIC MOTORS
and associated equipment
FOR THE OIL INDUSTRY



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Member of the A.E.I. group of companies

Motors for the Oil Industry

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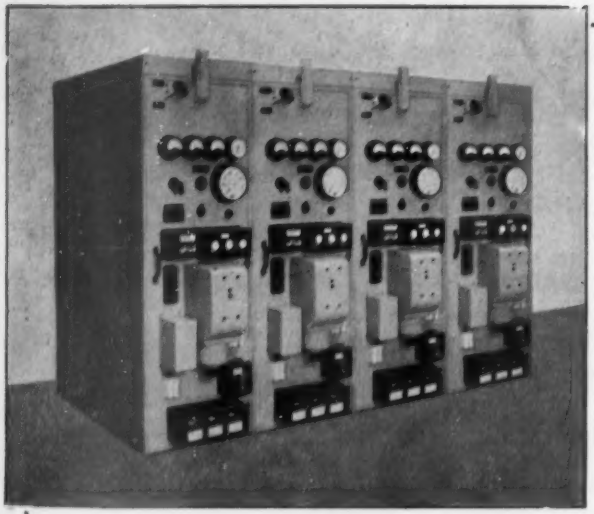
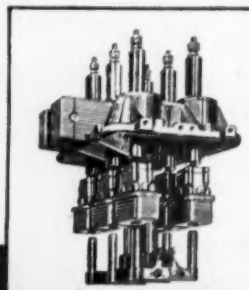


250 MVA
Switchgear
with
TYPE H. 25
oil circuit breakers
6·6 & 11kV.



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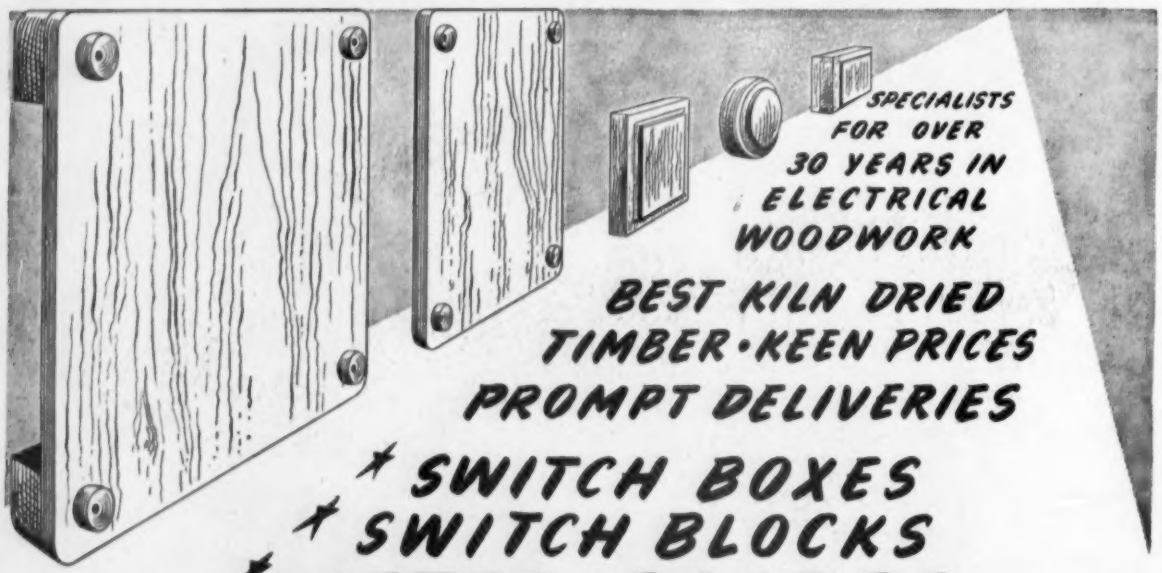
A2 *Associated with Hackbridge & Hewittic Electric Co., Limited.*



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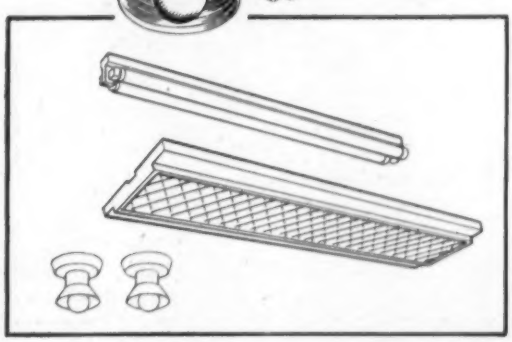
AMAZING LOW PRICE IS JUST ONE OF ITS SELLING POINTS!



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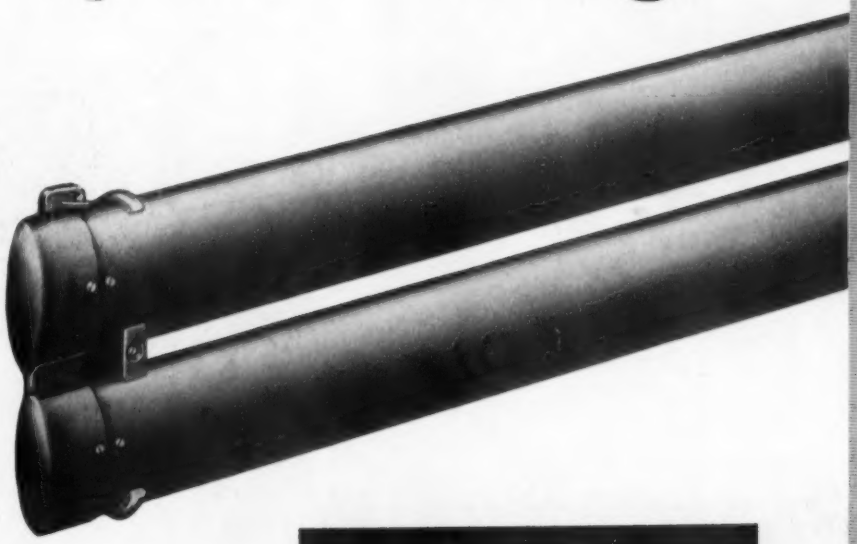
Space Heating



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TUBULAR ELECTRIC HEATERS

These heaters are easily installed, need no attention, can be thermostatically controlled and are available in lengths from 2 ft. to 17 ft. singly or up to six tiers. Ideal wherever space heating is required.

Maxheat ... the world's best sellers

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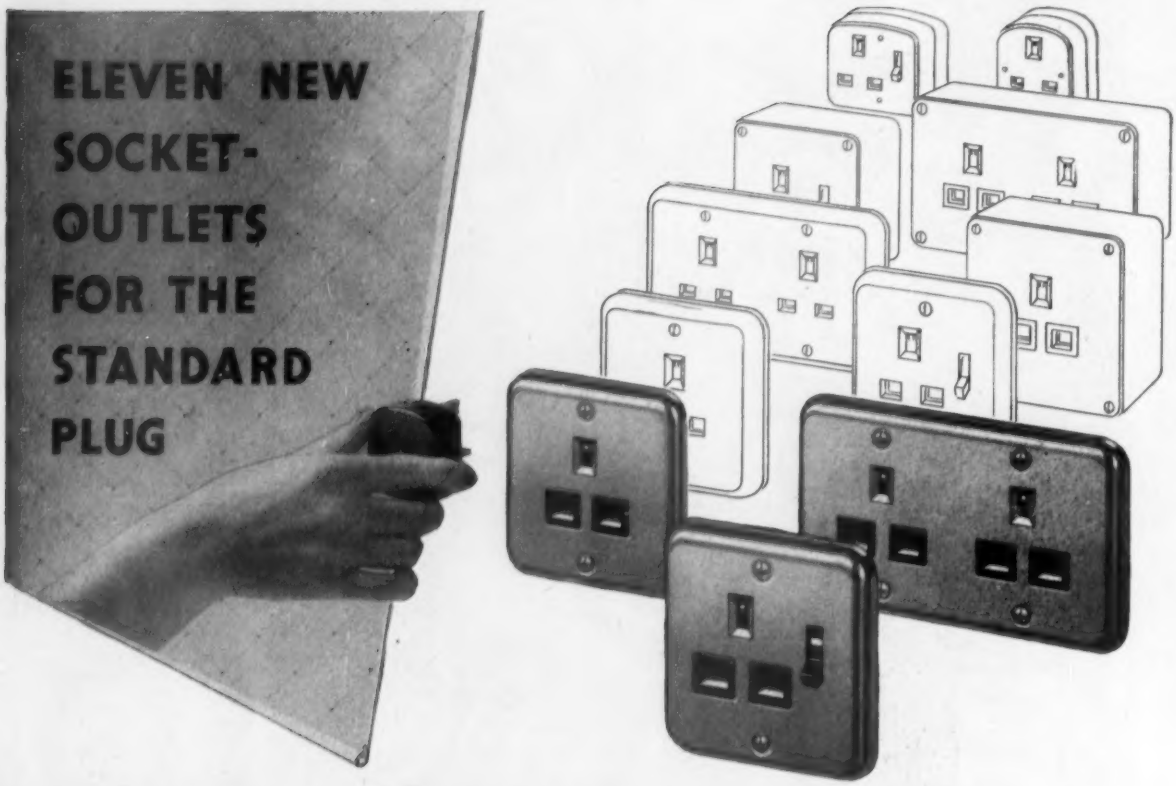
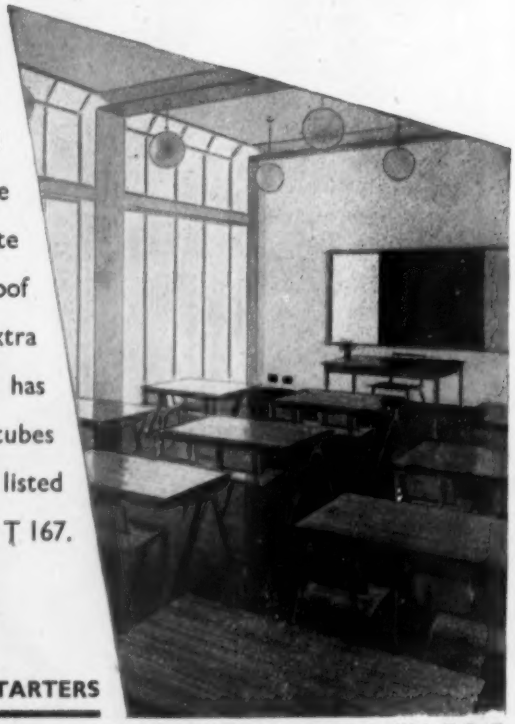


FLUSH UNITS WITH METAL PLATES

Wiring accessories in schools, hotels and public buildings are usually required to combine the neatness of flush mounting with the strength of a metal exterior. To meet such requirements the new Crabtree range of 13 amp. socket-outlets embodies a metal-plate alternative to each of the more popular shockproof patterns. Plates are of the "raised" type, giving extra wiring space, while a separate moulded component has been introduced to shroud the current-carrying socket tubes and to provide a flat bearing on the plaster. Full listed particulars will be found in Crabtree Publication No. T 167.



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WIRING ACCESSORIES · SWITCHGEAR · MOTOR STARTERS

"Crabtree" (Registered)

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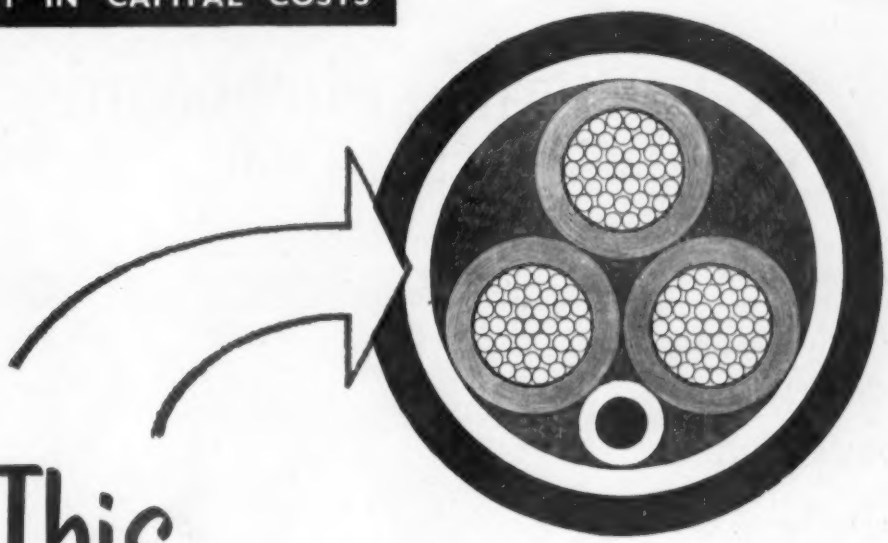
ECONOMY IN CAPITAL COSTS



This Aluminium Sheath ...

performs the functions of a normal lead sheath PLUS a reinforcement against the internal gas pressure, and a mechanical protection — providing economy in materials and lightness in construction.

SOME TYPICAL INSTALLATIONS

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10,690 yards laid between Perth Road Sub-Station and Buckhurst Hill Sub-Station.

Midlands Electricity Board
9,310 yards laid between Halford Lane Sub-Station and Handsworth and Freeth Street Sub-Station, Birmingham.

South East Scotland Electricity Board
Contract placed for 6,120 yards to be laid between Townhill Power Station and Netherton Sub-Station, Fifeshire.

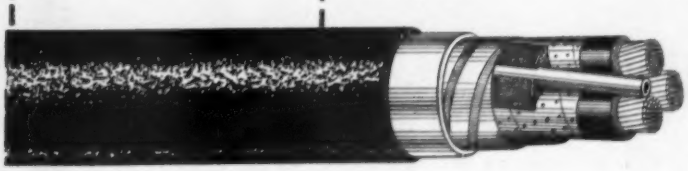
Brisbane City Council
Order in hand for 31 miles to be delivered to Australia.

Aluminium Sheathing is a notable advance in pressure cable manufacture.

Elimination of a separate reinforcement simplifies jointing, while the lighter weight makes the cable more convenient to handle, reducing transport and installation costs to a minimum.

Because of this, BICC 33kV Aluminium Sheathed Impregnated Pressure Cable can offer a saving of up to 25% in initial costs compared with solid types.

Further information is available on request.



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33 kV ALUMINIUM SHEATHED I.P. CABLE

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'Superform' switchboards

for the control of MEDIUM VOLTAGE circuits

Incorporating

H.R.C.

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FUSE-SWITCHES

in ratings up to

750 amps.

The new 'Superform' switchboard installed at one of the factories of Fisher and Ludlow's Material Handling Division, to deal with the heavy electrical demands of their new FLOWFORGE welding plant.

MODERN STYLING
Easy to clean smooth flush contour. Retractable switch operating handles.

SAFETY FEATURES
Busbars, connections and terminals fully insulated. Potential circuits fused at supply point. Integral cylinder locks fitted to fuse-switches.

PERFORMANCE
Fuse-switches proved for making capacity on 50 MVA. at 440 volts, 3-phase, 50 cycles.

ACCESSIBILITY
Hinged instrument panels give ready access to instruments, terminal boards and small wiring.

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fusegear

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Fusegear Division, East Lancashire Road, Liverpool 10

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COLOUR MASTERBATCHES which can be used to pigment natural-coloured VYBAK Plastic Compounds are now being produced by Bakelite Ltd. An addition of only 4% of this masterbatch is necessary to produce the required colour. Mixing is carried out by tumbling with the natural compound before feeding through the extruder.

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Instead of storing and handling large quantities of many different coloured compounds, you need stock only one basic natural compound and small amounts of each of the colour masterbatches. You can switch quickly from one colour to another without waste of existing stock.

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They never get past "ASHLAM" insulation board — there's a grade for every job.

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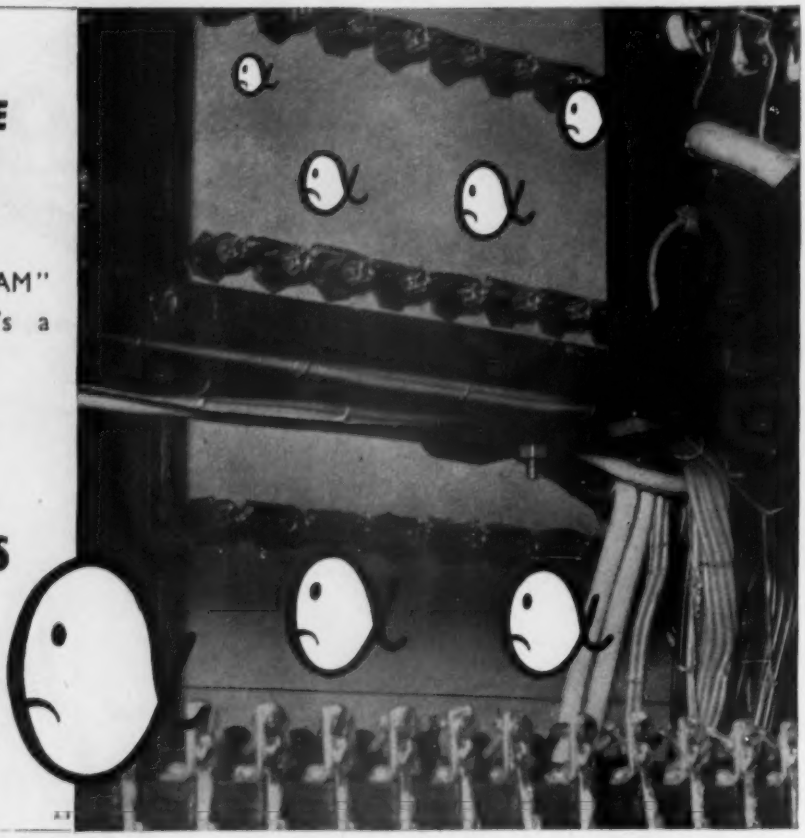

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Illustration is one of the many similar 11 kV sub-stations installed in the Home Counties.

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We are acknowledged as the pioneers of outdoor switchgear installations of this character. The quality and performance of IVIO switchgear is the result of over ten years of service experience in the most severe climatic conditions at home and abroad.

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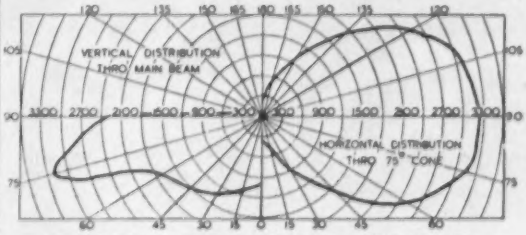
FOR HORIZONTAL BURNING SODIUM DISCHARGE LAMPS

MORE Light — LESS Maintenance

THE Golden Ray Mk. III is a solidly constructed lantern, for either side or top entry. Gives maximum light with a minimum of attention.

Its high optical performance is assured by an entirely new designed machine-cut " Perspex " prismatic refractor panel which ensures an efficient and balanced light distribution on the road surface.

Years of trouble-free service are assured by its sound engineering construction. Its sturdy top casting is die-cast from aluminium alloy. The refractor panel is hermetically sealed to the interior surface of the "Perspex" enclosing bowl, whilst a heavy felt gasket placed between the bowl and top casting acts as a further barrier to dust and dirt. All exterior small parts are made of stainless steel.



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Thousands of Golden Ray Lanterns have proved themselves in use with many local authorities. In Greater London alone, they have been installed by the Boroughs of St. Pancras, Walthamstow, Wandsworth and East Ham.

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'load of good wishes' for the New Year . . .

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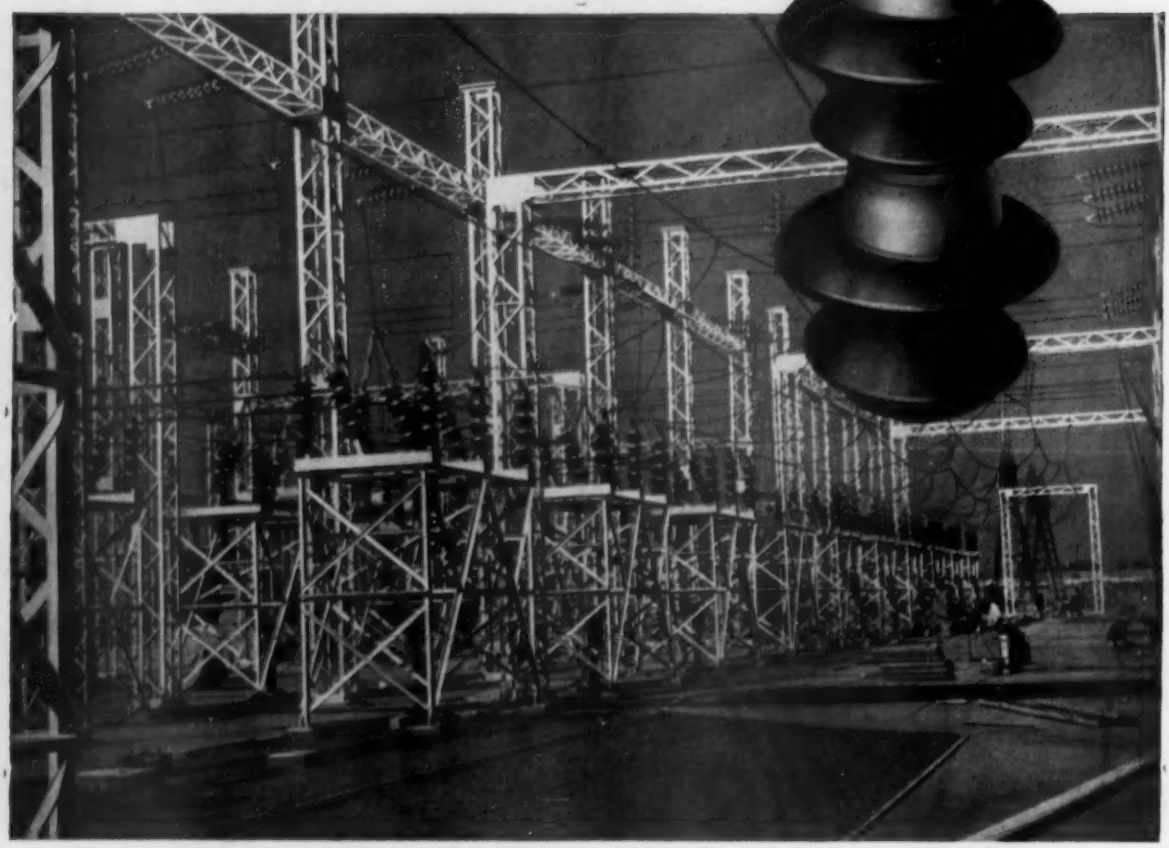

The 88 kV. Switchyard at Vierfontein Power Station of the Electricity Supply Commission (Rand Undertaking) is one of many for this Authority insulated with S.P.P. Posts of 4-units P.642.

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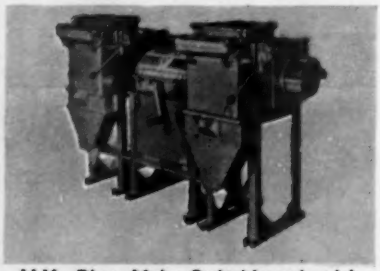
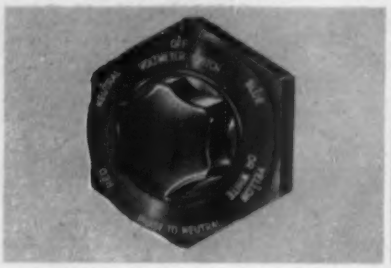
15 kV Oil Circuit Breaker for cubicle mounting

Heavy Current D.C. Circuit Breaker and Knife Switch Panel

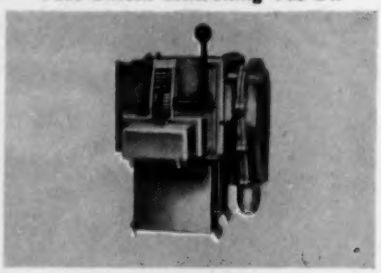


H.V. Ring Main Switchboard with Fuse Switch controlling Tee-Off

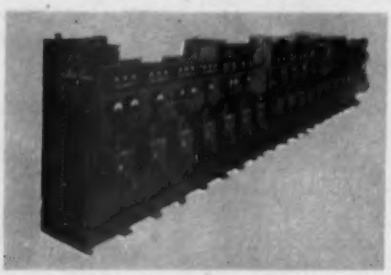
Small Air Circuit Breaker



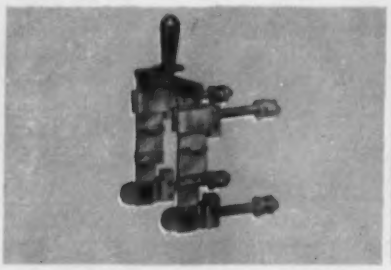
Ammeter and Voltmeter Switches



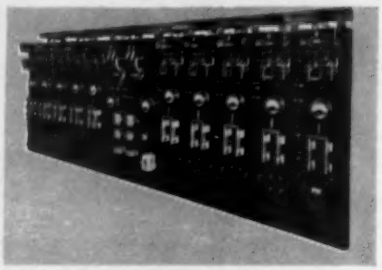
L.V. Industrial Oil Circuit Breaker



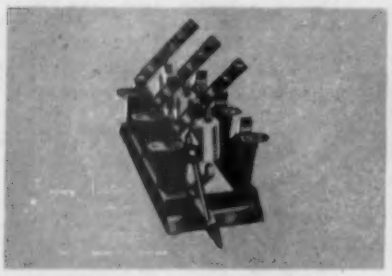
11 kV Metalclad Switchboard



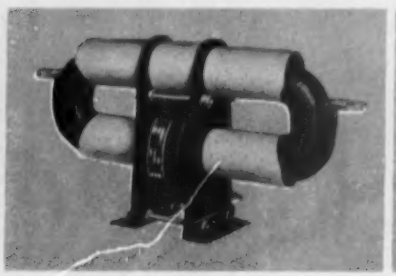
Panel Mounting Knife Switch



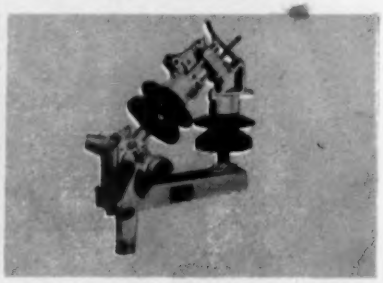
D.C. Switchboard for Steel Works



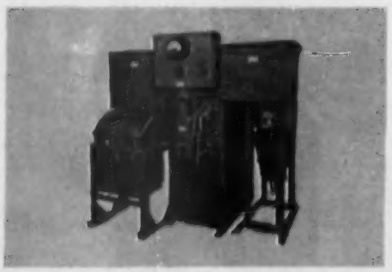
T.P. 11 kV Isolating Switch



Current Transformers



Outdoor Pole Mounting Isolators



H.V. Switchboard incorporating Automatic Fuse Switch

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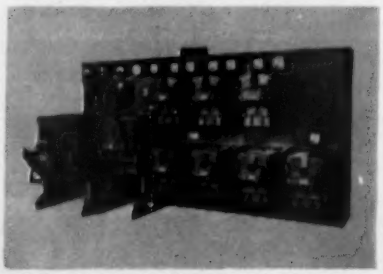
Specialists in Switchgear for over 50 Years



Industrial Switchboard with Drawout Oil Circuit Breakers

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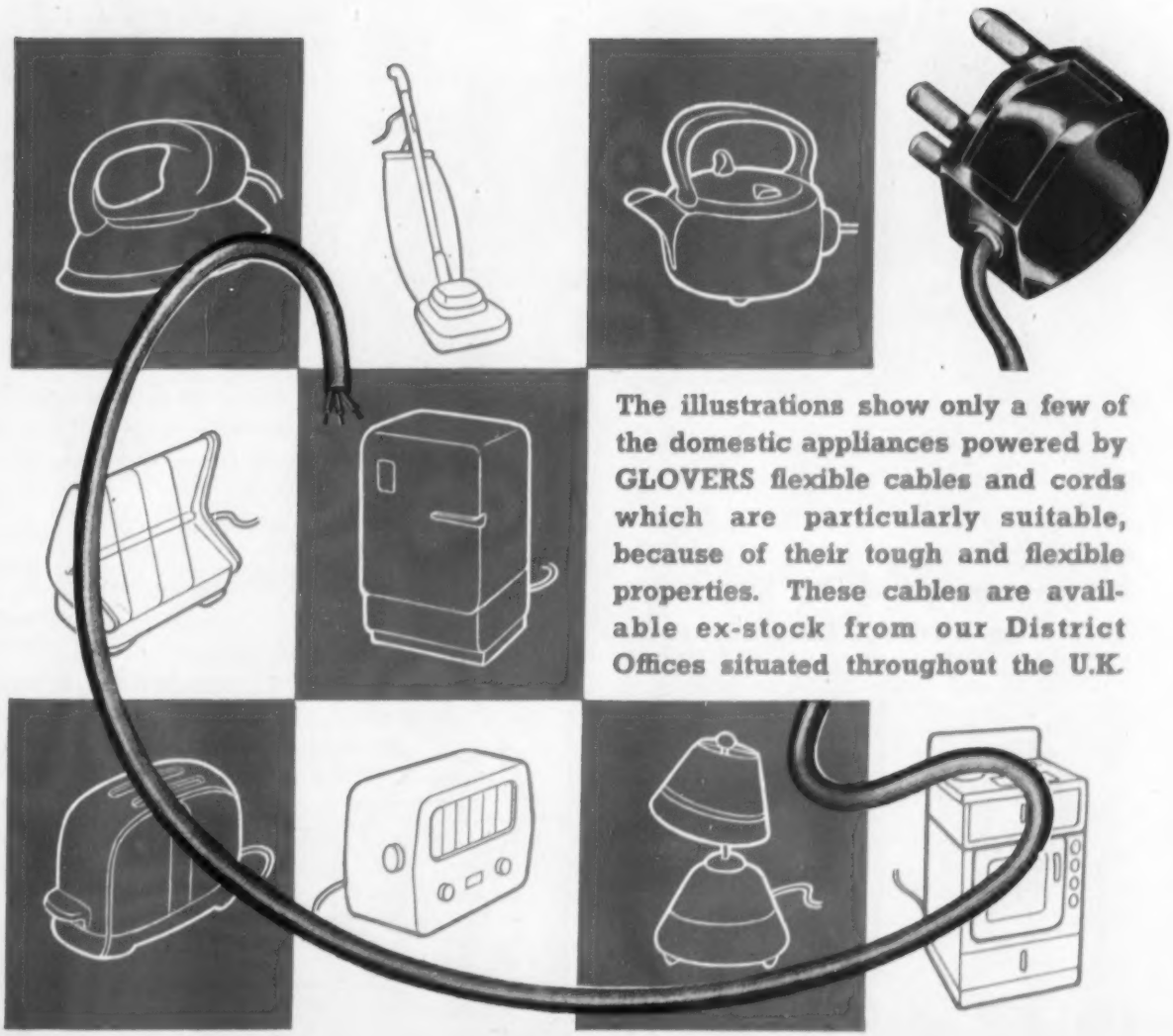

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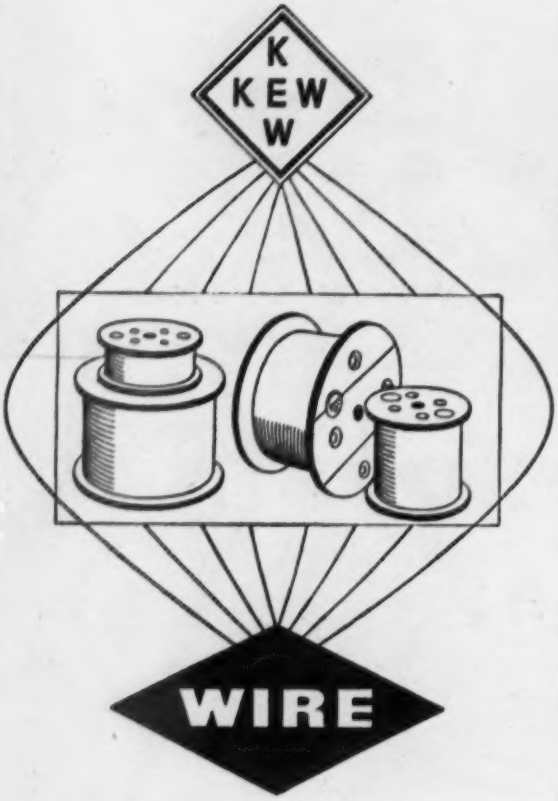

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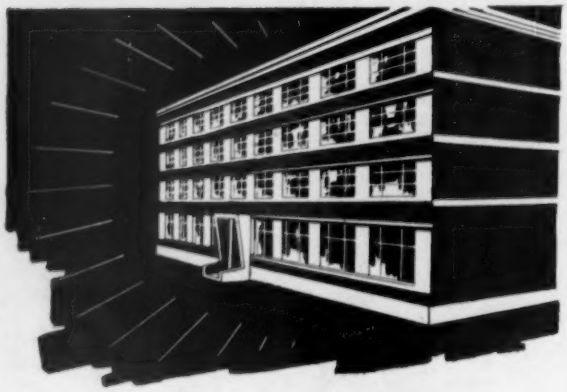

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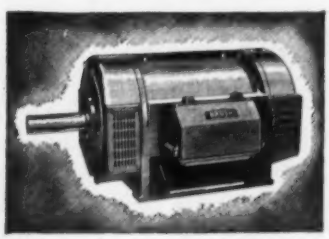

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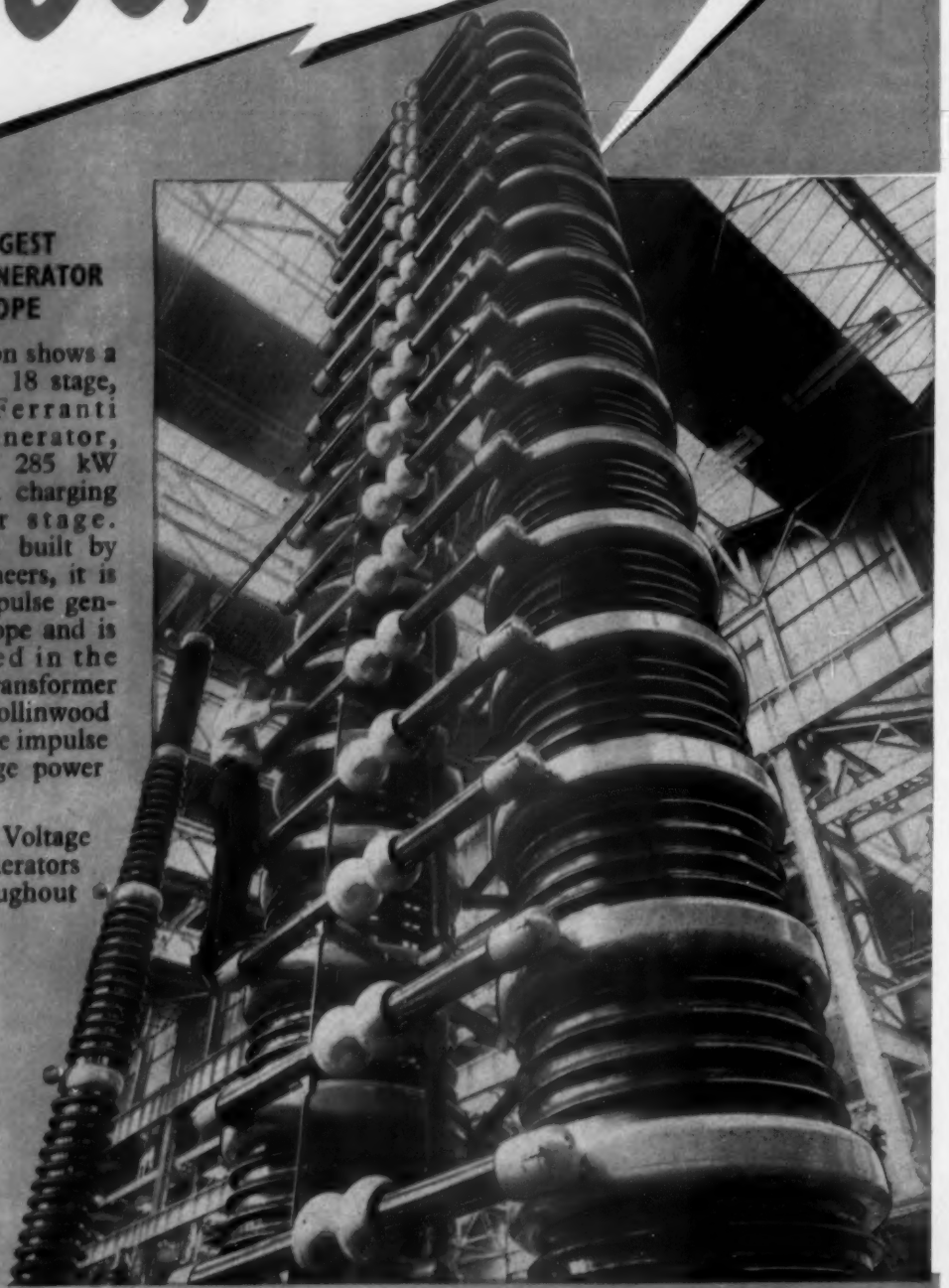

THE LARGEST IMPULSE GENERATOR IN EUROPE

The illustration shows a 4,000,000 volt 18 stage, 2 column Ferranti Impulse Generator, energy rating 285 kW seconds, D.C. charging 220 kV per stage. Designed and built by Ferranti engineers, it is the largest impulse generator in Europe and is now installed in the Ferranti Transformer Factory at Hollinwood for high voltage impulse testing of large power transformers.

Ferranti High Voltage Impulse Generators are used throughout the world.

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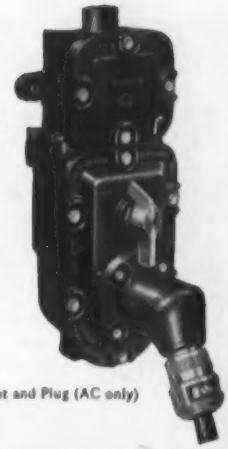

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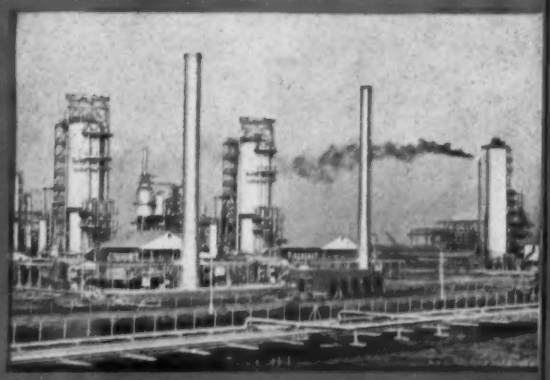

Flameproof on the Isle of Grain

Here's the scene at The British Petroleum Company's Kent Oil Refinery on the Isle of Grain, showing some of the main processing units. Simplex Flameproof Equipment is installed in this and many other refineries because the range of equipment has been designed to meet the most stringent requirements of the Oil Industry. Note too, that Simplex are constantly expanding their range of Flameproof gear. Additions to the Simplex Flameproof range include SWITCH, PUSH BUTTON, PILOT LIGHT and METER UNITS.

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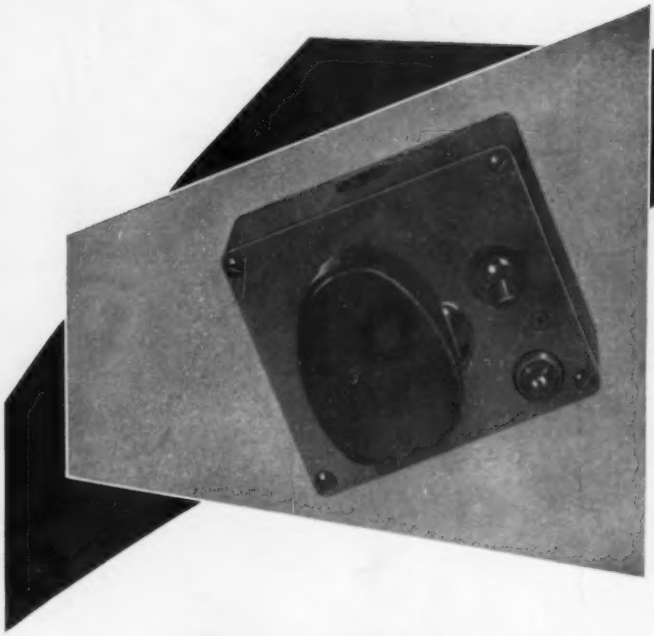

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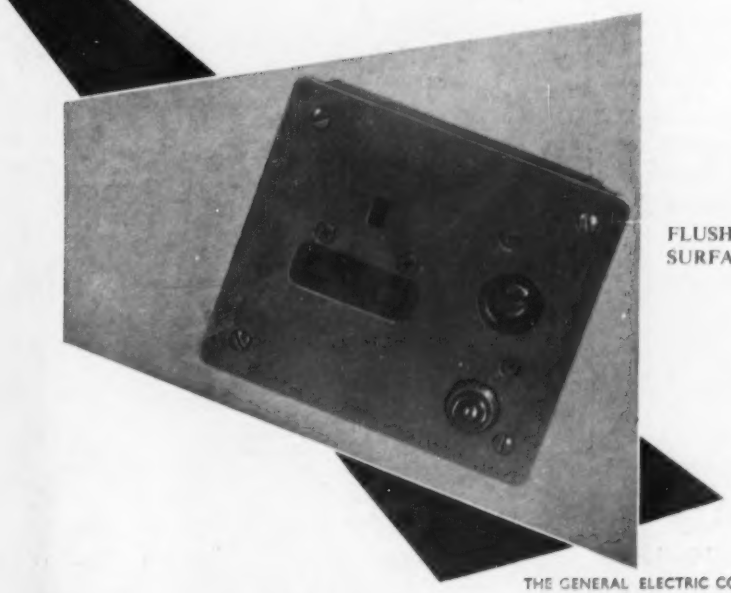

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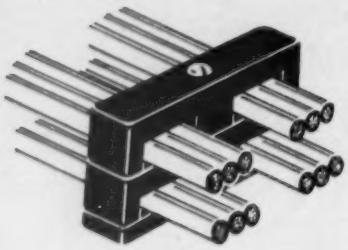

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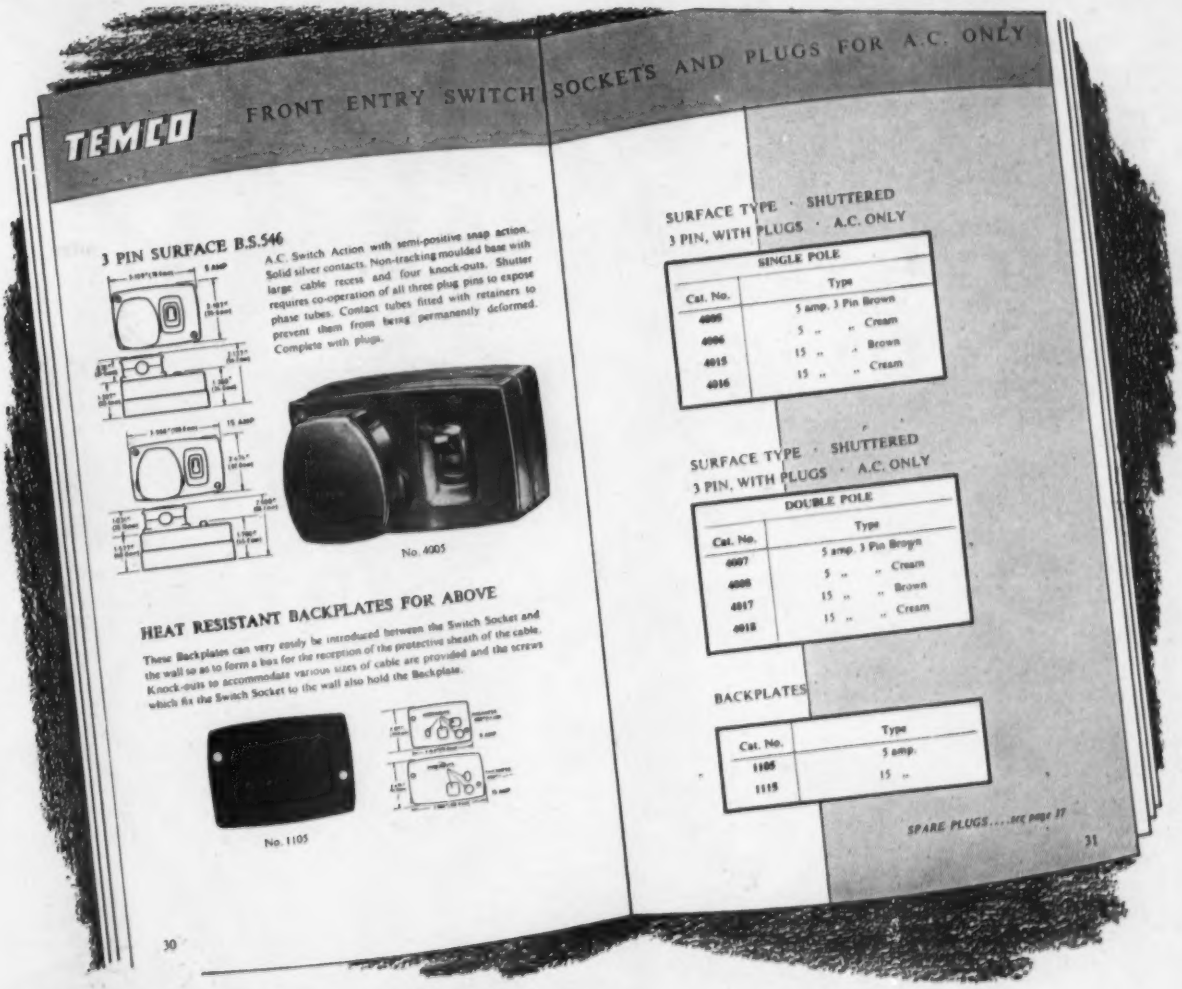
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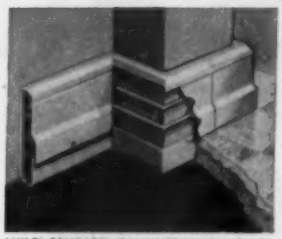

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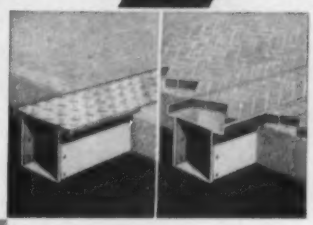

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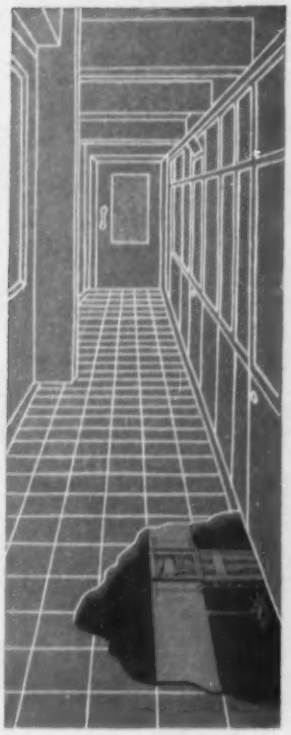

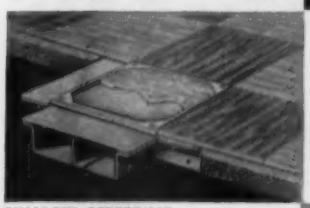

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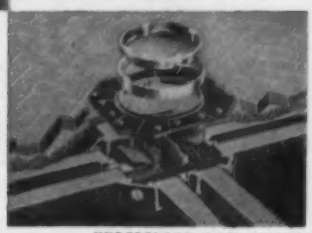

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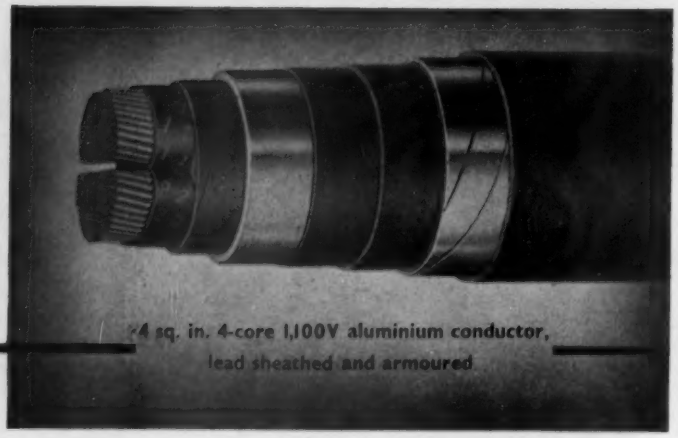

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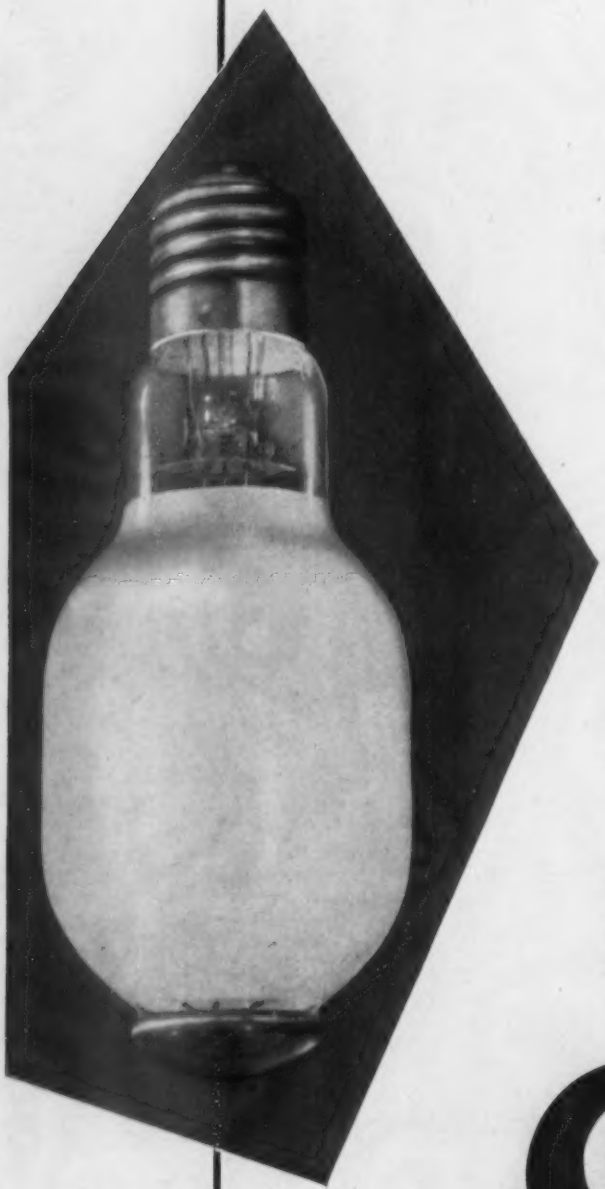

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 15 DECEMBER, 1955
Volume No. 128 Number 3345
REGISTERED AS A NEWSPAPER

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2.
Telegrams: Equivolt, Estrand
Telephone: HOLborn 6016

Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law
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BAN ON HIRE

Although the credit squeeze seems to have been in the news for a long time, some of its effects are only just percolating through the commercial system to the ultimate consumers and those who serve them. There is a sign of this delayed action in the making public this week of an agreement between the electricity and gas authorities at national level, that there shall be no new simple hire agreements for domestic appliances in the new year. The agreement is effectively binding on all electricity boards, although some of them no doubt dislike it; and it has already called forth a strongly worded protest from the East Midlands Electricity Consultative Council. There are, of course, comparatively few boards which seek new hire business, but the effect of the new agreement will go deeper than this fact may suggest at first sight. A factor in the past decision of some boards to avoid simple hire has been the near-equivalent conditions offered by long-term hire-purchase agreements, ranging in some cases up to as much as ten years for cookers. This alternative approach to the problem of giving the consumer his larger appliances at low weekly costs has not been available, however, since restrictions on hire-purchase terms were applied earlier this year as one of the first signs of the increasingly stringent financial control being adopted by the Government. With this statutory restriction in mind, the present plan to eliminate hire is seen to imply abandonment of the last position in the defence of low cost facilities for domestic consumers.

SHORT-CIRCUIT SHORTCOMINGS

Power stations and most substations rank as factories in the eyes of the law, and so receive attention in the annual report of the Chief Inspector of Factories. In the newly published report for 1954, indeed, more space is given to the supply industry than to electrical aspects of manufacturing concerns. One section of particular interest deals with the short-circuit rating of circuit-breakers. The Electricity Regulations under the Factories Acts, drawn up long before high short-circuit powers became a serious problem, do not, of course, cover the point specifically. None the less, adequate capacity is required in general terms, and so the Factory Inspector is enabled to voice the concern felt by many engineers at the large number of circuit-breakers not up to present-day standards which are now in service on distribution systems. This is essentially a replacement problem, for growing networks with higher prospective faults have combined to make inadequate

circuit-breakers still satisfactory in terms of load carrying capacity alone. There have been several signs in recent months of the growing urgency of this problem in terms of extensive breakdowns due to circuit-breaker failures, but it is unrealistic to expect a really swift solution, for the financial burden of modernisation is heavy as the present report emphasises. Nevertheless, progress should be steady, and the Factory Inspector's report is a reminder that in this respect the compulsion of statutory requirements is added to the pressure towards improvement of supply continuity considerations.

TRAINING TECHNICIANS

Recent weeks have been a lively time for the planning of engineering education. Last week we were considering in these columns the new National Council scheme for technologists, which aims to provide a publicly recognised award of first degree standard for the professional engineer who trains at a technical college rather than a university. Such an award is in some ways an advance on the Higher National Certificate scheme, although this will remain in essentials one route to professional recognition. This week a new qualification that will be in many ways an alternative to the O.N.C. course is in the news. Its end award is a Technician's Certificate, and an appropriate course will be sponsored next year by the City and Guilds of London Institute. Active encouragement by the I.E.E. and various other interested associations has led to the provision of this new training route for the electrical technician, so important a link in today's chain of engineering organisation, though one whose existence is more readily recognised than clearly defined. The reception given to plans for the course at a meeting of interested authorities organised recently by the I.E.E. confirms the need that is felt throughout industry for additional provision of this nature. Throughout the syllabuses for the course there is concentration on the less purely scientific aspects of electrical theory, which many will welcome; and there is a flexibility in subject matter, particularly appropriate to a group of men with such diverse interests and technical standards. The task remains, however, of convincing students of the value of the course in its own right. It must be made clear that it is not merely a lower-standard alternative to National Certificate studies.

AUTOMATION OVER-PLAYED?

Forecasts for conditions a quarter of a century ahead are usually too vague to permit detailed analysis. Not so the suggestion by the Chancellor of the Exchequer that it may be possible for the people of this country to double their standard of living in that period. Many have examined this optimistic prognosis from specialist points of view, and last week to the chorus of comment an electrical opinion was added by Professor Arnold Tustin, in his inaugural lecture as Professor of Heavy Electrical Engineering at Imperial College, London University. Professor Tustin calculated that the rate of expansion of the industrial use of electricity needed to attain this goal was 7·1% per annum, a figure that is close to the conventional doubling in every ten years. But increased electricity consumption is only a sign of more and different machines, and when he came to consider the facts behind the figures, Professor Tustin departed from the line taken by many prophets of the industrial future. He specifically expressed doubts whether automation will indeed play a major part in industrial expansion in coming years. Rather, he suggested the more conventional line of engineering advance through the development of new and better materials, and means of applying them more efficiently, will provide the key to the hoped-for improvements in living standards. Such a relative discounting of the automatic factory idea is unfashionable at present, but the opinion has a common-sense ring that will no doubt recommend it to many engineers.

PROTECTION OF UNIT ALTERNATORS

The growth of power networks, the continuous trend towards large unit generators, and the introduction of high voltage bulk transmission are all factors which have increased the responsibility and the complexity of of protective equipment. Some idea of the growth and development of protective techniques in this country is provided in the article which we are publishing in this and following issues. Of particular importance, in view of the capital costs involved, is the protection of large unit alternators. The electrically "solid" connection of alternator, generator transformer, and auxiliary (or unit) transformer, while simplifying the arrangement, introduces major problems of protection, and the problem of phase unbalance has become more important with the introduction of hydrogen cooling. The cost of protection is high, but the cost of breakdown in a large modern machine well justifies the outlay.

H.P. PIPE WELDING

The bottleneck in quality pipe welding facilities experienced by the Admiralty immediately after the war led to an investigation into the potentialities of adopting an automatic pressure-controlled hot-welding method for the butt welding of high-pressure steam pipes and flanges. So successful has the dockyard experience proved, that this technique is now being developed under Admiralty Contract, to embrace the commercial field. Claims made for the system are extensive; they include the use of comparatively unskilled labour—a major cost factor under present circumstances—rapidity of operation, elimination of welding rods and production of high quality consistent welds. Experience is at the moment limited to mild, carbon molybdenum and chromium molybdenum steels, in pipes up to 8 in. outside diameter with a maximum wall thickness of ¾ in. The Admiralty report, summarised on page 920 of this issue points out, however, that there is no reason why more highly-alloyed pipe steels could not be handled. Nor from the description given of the process, does there appear to be any cause for thinking that the method is restricted as far as size is concerned. Final judgment must necessarily be suspended until commercial models have been developed and proved, but there is certainly a good case for assuming that a most important stride forward has been taken, if not in site welding, certainly in factory fabrication.

Meteor

Protective Equipment for Electrical Systems

PART I

A REVIEW OF THE DEVELOPMENT OF PROTECTION TECHNIQUES AND APPARATUS

By **W. CASSON, M.I.E.E.** *Head of Transmission Design Engineering Branch of the Chief Engineer's Department, C.E.A.*

IT is both prudent and instructive to stand back occasionally and examine the present state of knowledge and practice in a section of engineering activity; to note what progress if any has been made, and to create a picture of the problems and requirements of the future. That is the purpose of this short review of past and present practice in one important section, namely the protection of the component parts of the country's electricity supply system.

Experience in both the transmission and the distribution systems over the past 20 years has shown the value of sound protective schemes and of the need for their continual improvement and for new developments to keep pace with the expansion of the industry, the growth in size of individual components such as generators and transformers and the increasing short-circuit levels.

Prior to the second World War some attempts were made to assess the performance of protective gear chiefly for the purpose of finding out those designs of protective gear which were worth while continuing and those which should be discarded. The Central Electricity Board commenced to assess the protective gear on their 132 kV and 33 kV systems on a strict basis in 1937 and the first year's system fault performance index was only 85%. The figure increased to a maximum of 94·8% in 1947 a value considered by many people to be about the economic optimum figure. After nationalisation the Central Electricity Authority continued to assess the protective gear performance on the same basis as the C.E.B. but the systems concerned now include the generating stations. During the years of the heavy construction programme since 1948 the index dropped to 86% in 1953 but the figure for 1954, 92·1%, shows a considerable improvement.

In recent years an attempt has been made by C.I.G.R.E. to introduce an international basis for assessing the performance of the protective gear on systems at 20 kV and above. Thus it will in future be possible to obtain world-wide statistics of experience with various protective gear schemes which should be of considerable value to both designers and users.

System Changes

During the last 20 years the character of both transmission and distribution systems has altered. Originally the main function of the former was to provide interconnection between generating stations, only a few bulk supplies being given direct from the Grid, the distribution systems being mainly based on the generating stations. Now with expansion due to growth of load, the distribution systems have been carved up into units, some of which remain based on the generating stations while others are directly supplied from the Grid. When the 275 kV Grid is in commission the main function of the interconnection will be transferred to that system leaving the 132 kV system for purposes of bulk supply and regional pooling of generating plant.

On the transmission system the changes have required that more consideration be given to the rapid clearance of faults with discrimination, and to the ability of the protection to operate over the wide range of fault current infeeds created by changes in generation which take place throughout the day, in order to achieve the most economic operating conditions. Whereas in the early days the generators were connected at the voltage of distribution, most of them are now connected at 132 kV and in the future many will be connected at 275 kV.

Although there is a tendency to restrict short-circuit levels at the receiving points of bulk supply to 750–1,000 MVA, the maximum levels at the 132 kV and 275 kV switching stations are increasing and in some cases it has been necessary to sectionalise the system in order to keep the short-circuit levels within the rating of the switchgear.

The transmission substations in the past were generally of the double busbar, mesh and three-switch types. Other types are now being introduced which economise in circuit-breakers and employ motorised isolators for the connection of transformers tapped off lines. Transformer feeders both in the transmission and distribution systems are now in greater use than before and these are often tapped at several points. The heavy cost of manning switching stations has led to the greater use of automatic transmission substations and to the control of a number of substations from one point. The pro-

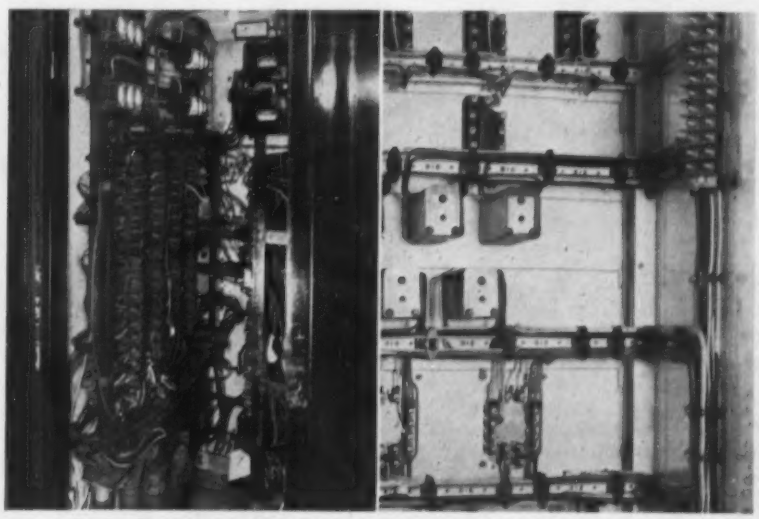


Fig. 1. These pictures illustrate the improvements made in panel wiring practice

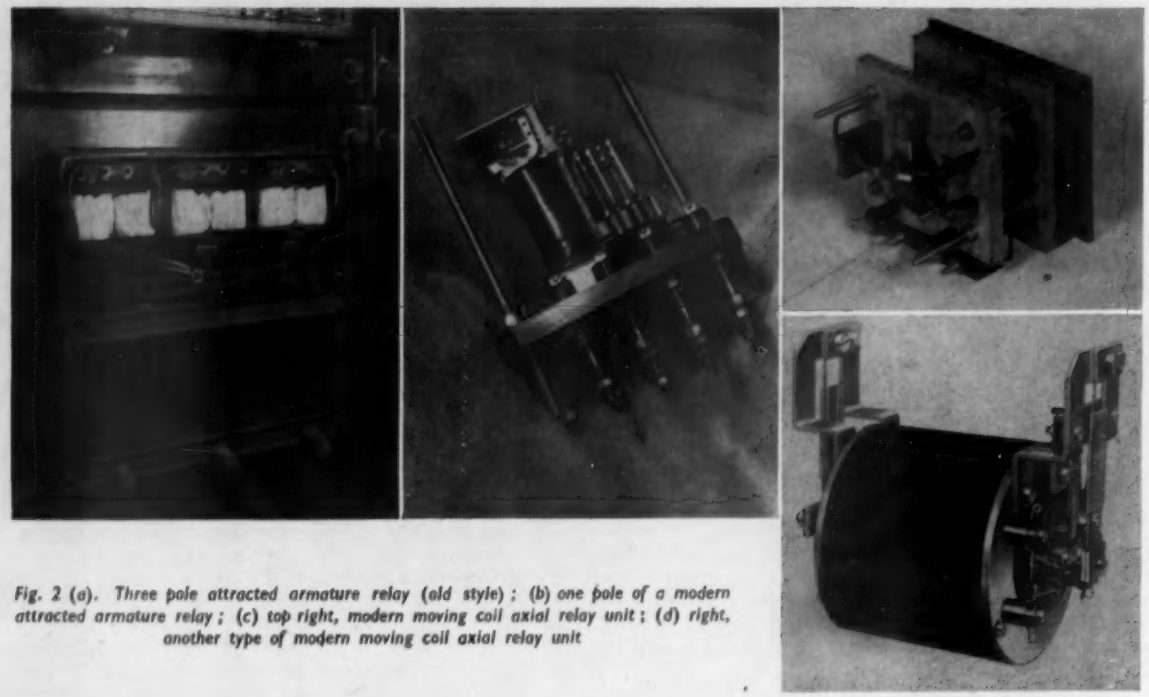


Fig. 2 (a). Three pole attracted armature relay (old style); (b) one pole of a modern attracted armature relay; (c) top right, modern moving coil axial relay unit; (d) right, another type of modern moving coil axial relay unit

tective arrangements have had to be designed to meet all these new conditions. In the future more automatic schemes will be introduced and it is interesting to note that in the U.S.A. some large double busbar stations have been made fully automatic even to the extent of energising the busbar section after it has tripped on fault and, if successful, closing the bus coupler, and then reconnecting all the circuits previously connected. Such automatic schemes require sound protective gear and efficient maintenance if they are to be reliable, as their failure to operate satisfactorily can create much confusion among those responsible for operating a power system.

Protection for Feeders and Transformer-Feeders

Feeder protection schemes can be divided into those which require a communication channel between the ends of the circuit and those which do not. The former are principally of the "unit" type and generally do not incorporate a back-up feature which is inherent in the latter.

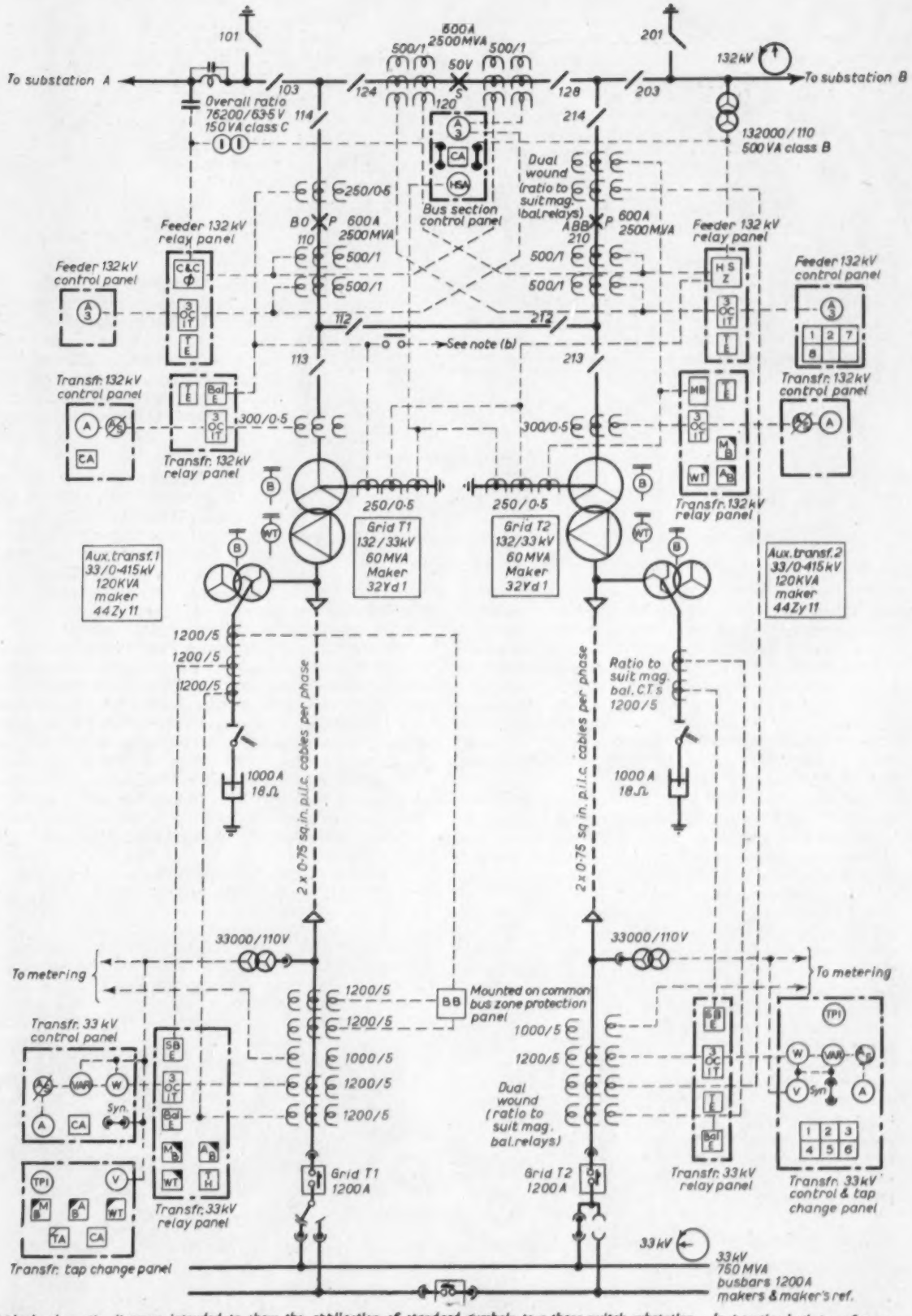
Protective Schemes using Communication Channels: The earliest schemes using pilot wires were of the Merz-Price circulating current and opposed voltage types with a fault detector and a pilot-core associated with each phase. This form of protection was expensive in pilot wires and required special current transformers. As the length and voltage of feeders to be protected increased schemes were developed on similar principles but using orthodox c.t's with summation arrangements to obtain a single-phase current from the three phases. Some required only two pilot wires and all used small currents in, or low voltages on, the pilots. Schemes using either the opposed voltage or the circulating current principle are now available in which the pilot wire voltages and currents do not exceed limits stipulated by the G.P.O. Multi-ended circuits for which pilots are available can also be protected by circulating current or opposed voltage schemes.

During the last war a scheme of pilot wire protection employing the phase comparison principle using ultra-high-speed relays was developed and many equipments are in operation using P.O. circuits. These circuits are normally connected to pilot supervision equipment and in the event of a system fault are automatically transferred to the discriminating relays.

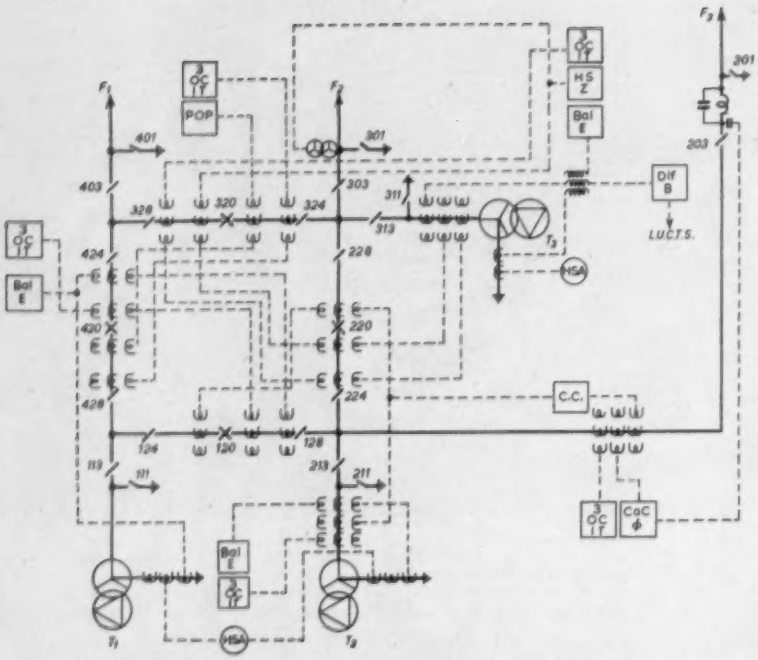
Protective schemes employing the direction-comparison principle have been used on the Grid since about 1930 with satisfactory results and the time of operation has been decreased to about 0·1 second. These schemes employ either P.O. wires or carrier current signalling channels but they are now being superseded by schemes, mainly of the carrier current type, using the phase-comparison principle, which are cheaper overall and give more certain operation on close-up three-phase faults. These phase-comparison carrier current schemes are already in use on the 132 kV system and will be widely used on the 275 kV system.

Protective Schemes without Communication Channels: Directional-overcurrent relays have been in use for a long time on both the transmission and distribution systems for circuit protection. The main change which has taken place in the past 20 years is in the connection of the polarising coils of the directional elements to suit the application. Directional relays have been developed with as many as four elements operating on a common spindle; and with the latest designs of single element relays very short operating times are possible. The limitation of directional relays has always been the close-up three-phase fault condition but developments are in progress to overcome this limitation by means of memory action. This method has long been in use in U.S.A. but is only now being considered here. Memory action is only a partial solution, however, since it is not effective when a breaker is closed on a dead line with a three-phase fault, unless the voltage transformers are busbar connected.

Most of the overhead line circuits at the inception of the



Typical schematic diagram intended to show the application of standard symbols to a three-switch substation. In practice both transformers would have similar protection; (b), this connection parallels the transformer 132 kV protection when the by-pass isolator 112 is closed



Typical protection arrangement at a 4-switch mesh station

Grid system were protected by low-speed distance relays either of the impedance type or the reactance type with sloped characteristic. In the early impedance equipments separate elements were used for phase faults and earth faults but at a later stage three elements were used for phase faults with changeover arrangements for earth faults. This latter arrangement has been found to be unsatisfactory on complicated faults. The time of operation of this low-speed distance protection is of the order of 0·25 second for close-up faults and 0·7 second for far-end faults.

Some years later high-speed distance equipments were developed and installed. These were of the stepped-time impedance type with three stages; later equipments used high-speed impedance relays for the first stage and reactance relays for the second and third stages. The operating time of this high-speed distance protection is of the order of 0·1 second for close-up faults. In recent years, in this country, improvements have been made in high-speed distance protection in particular the use of separate relays for earth and phase-to-phase faults but with fewer measuring elements. The reduction is due to the use of a common measuring element in each phase for all three stages.

Mho relays are now receiving consideration chiefly owing to the advantage they give in being stable under power-swing conditions and in providing very sensitive settings.

On the trunk distribution systems distance protection has not been used very much in the past but may be used more widely in the future, particularly as an alternative to overcurrent relays at the supply end of the first circuits feeding into a ring main system when it proves unpracticable otherwise to ensure that faults in those circuits are cleared within the accepted maximum time of 1·0 second.

Communication Channels

Prior to the construction of the Grid, communication channels took the form of private pilot cables laid with the power circuit when underground or slung from a catenary wire when overhead. When the first section of the 132 kV Grid was designed it was found to be impracticable to use pilot cables slung from a catenary wire and so consideration was given to rented G.P.O. circuits and to carrier current channels over the main conductors. The earliest form of carrier current channel employed only one conductor with earth return but subsequently two phases were employed which increased the cost but reduced the possibility of interference. Consideration is now being given to the use of special signal conductors on overhead lines for h.f. signalling.

Although experiments carried out over 20 years ago with private pilot wires embedded in insulation within the earth wire on overhead lines were unsuccessful, now with improved insulation this type of channel can give satisfactory results provided that precautions against induced voltages are taken on the connected terminal equipment.

Radio channels have become a possibility in the post-war era. Although such channels are in use on a small scale in the United States for protection signalling, so far they have not been used in this country for that purpose. Experiments are being carried out with a trial installation but there are many difficulties to be overcome before this form of channel can be considered for general use.

Wires rented from the G.P.O. are attractive as channels for protective gear purposes and their use has increased considerably over the last 15–20 years. The Post Office are asked to provide underground cable circuits for these channels where possible. Although P.O. lines, not being in the control of the user for repair and maintenance, are less reliable than private pilots, they nevertheless provide an acceptable standard of service with an alarm scheme to detect short circuits and open circuits. It has, however, been found desirable to provide means for rapidly disconnecting the trip circuit of protection when indication of failure of its pilot circuit is received.

Apart from the use of communication channels as an integral part of the circuit protection there is also a need for such

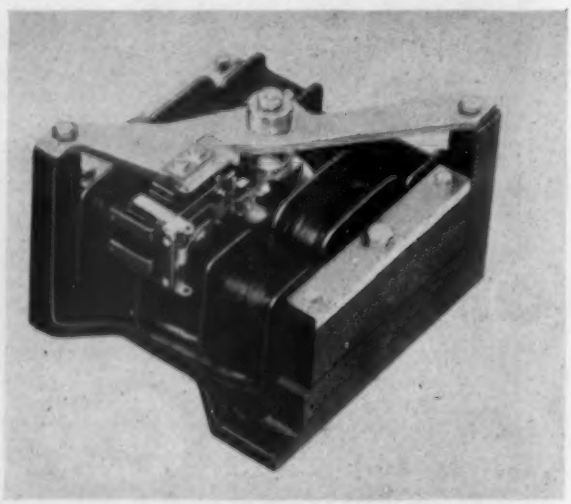


Fig. 2 (e). Modern induction cup relay unit

channels for intertripping purposes especially if the protected circuit includes a transformer.

Twenty years ago most of the intertripping schemes used battery operated sensitive attracted armature types of intertripping relay. Trouble was experienced with these schemes due to relays operating inadvertently when pilot earth faults coincided with system earth faults, and this led to the development of intertripping relays which were unaffected by this condition.

Intertripping schemes using coded v.f. impulses over P.O. circuits were first used on the Grid in the middle 1930's mainly as back-up for distance protection in South West England on account of the low fault current infeeds experienced under certain conditions. These schemes are of the low-speed type and have generally operated satisfactorily. With the greater use of transformer-feeders somewhat simpler equipments using coded d.c. pulses were developed. These also are low-speed and there is now a demand for faster operating equipments but it has not been possible yet to reduce the operating time below 0·35 second with safety against inadvertent operation by interference. Development work is proceeding on fast operating equipments over carrier current channels for intertripping in connection with 275 kV transformer feeders and trial equipments will shortly be installed on the Grid. Where feeder protection is of the unit type it is possible to achieve intertripping by short-circuiting (or open-circuiting) the pilot wires or otherwise interfering in the communication channel at one end and so to cause tripping at the other end. For transformer-feeders this action must be replaced by the injection of d.c. or a.c. signals from auxiliary supply sources into the protection pilot wires, or into additional pilot circuits provided for intertripping purposes. In the latter case, the action could supplement interference in the protection channel.

Single-phase to earth fault-throwing as an alternative to intertripping through a communication channel is being increasingly used at voltages up to and including 132 kV and was first introduced about 20 years ago by the C.E.B. at 33 kV. Compared with other forms of intertripping, fault-throwing scores on the grounds of simplicity, lower initial cost and reduced maintenance. The time of operation of a fault-thrower is 0·4 second at 132 kV and 0·2 second at 33 kV.

(*To be continued*)

TRAINING AND PRACTICE IN LIGHTING

Co-operation between Lighting Engineer and Architect discussed at I.E.S. Meeting

LAST Tuesday's joint meeting of the Illuminating Engineering Society and Royal Institute of British Architects further emphasised the need for co-operation between architect and lighting engineer to secure architectural unity, in a paper by D. Phillips discussing the training for and practice of lighting in buildings. An overall picture of completed installations in this country shows, however, that lighting is more often a disorganising feature of, rather than a positive contribution to, such unity, resulting from what might be described as "traditional animosity" between the two fields.

The basis of a profession lies in the training of its students, and a brief analysis of the educational requirements of the two professions is revealing. Firstly, it shows that the R.I.B.A. examinations virtually ignore lighting, and consequently architectural students can reach the end of their training with little or no knowledge of either natural or artificial lighting, and secondly, that students of illuminating engineering can complete the course for the City and Guilds examinations (and gain full marks) without having any knowledge of the buildings for which, as lighting engineers, they will be planning lighting schemes. Furthermore, it is possible for them to obtain full marks without answering any questions about "man." This suggests that at the end of their training each profession will know very little about the aims and problems of the other, a situation which can only lead to lack of understanding and an inability to co-operate.

Fundamental Requirements

In simple terms the subjects about which knowledge is necessary for the design of lighting in buildings are Man, Light, and Architecture. Generalising about each of these in turn it may be said that the architect appreciates man's aesthetic needs in terms of lighting, whilst the engineer takes a scientific view; the architect has a layman's attitude towards light, whilst the engineer has technical knowledge; finally the architect is concerned with architecture as an art and science, having a technical understanding of its difficulties, but the engineer's interests are restricted to the technical problems involved. The only common meeting ground is in the technique of placing lighting equipment in buildings, but there is an absence of any common vocabulary of design. It is evident that the training of the two professions should be modified to enable these gaps to be bridged. In this way the architect should think of lighting in the initial stages of design, and the lighting engineer will acquire a sensitivity towards architecture.

This will require an effort on the part of the educational authorities in the training of suitable staff and in the initiation of schemes likely to promote closer co-operation between the professions at both student and professional levels. The criteria upon which lighting design is based must be under constant review, and architects and lighting engineers have a part to play in establishing valid criteria which integrate the principles of architecture and the total needs of men.

Present Practice

Present lighting practice, in which the lighting equipment manufacturer is left to plan and design lighting schemes for buildings, can be criticised on the ground that those designing the lighting are unqualified to deal with architectural problems, whilst the equipment at their disposal is limited to that manufactured by their company. The modifications to the educational facilities which are suggested should lead to a new relationship between the architect and the lighting engineer, more in line with the architect's relationship to other consultants, in which the professional status of the lighting engineer is increased. The architect would consider the lighting of his building initially and the lighting engineer would co-operate with him on the more complicated problems. The lighting engineer might be with one of the existing firms of electrical consultants, a member of a partnership covering such subjects as heat, light and sound, or even a specialist member of an architectural partnership, but would be without any commercial attachment. The role of the lighting equipment manufacturer would then be primarily concerned with the development of equipment to meet the pattern set by architects and consultants as the initiators of lighting schemes.

Measuring Field Current without Shunts

MODERN power station design usually locates the control room a considerable distance away from the turbo-alternators. Transference of measurements of a.c. voltages and current present small difficulty as instrument transformers can be selected to give adequate output and accuracy: nor does the indication of d.c. voltage provide a problem. The situation with d.c. current is, however, less easy to deal with as the shunt must be located near the alternator to save cabling cost, and the consequent long instrument leads may introduce considerable errors due to temperature changes. The low voltage across the shunt also makes the system particularly susceptible to small changes in contact resistance. To eliminate these difficulties, the British Thomson-Houston Co. have introduced a transductor (magnetic amplifier) method of remote indication. Two units are used, connected as shown, which produce an output of a.c. of substantially rectangular wave-form, having a peak value proportional to the d.c. flowing in the primary winding, and this can be measured either on an a.c. or a rectifier type of instrument. The transductors can be of any shape (ring cores, rectangular cores, two separate units or combined units on a 3-leg core). The ratio error can be made less than 1%, and within wide limits the error is independent of the burden, and accuracy is maintained over a wide metering range from, say 25% to 125% of rated current.

A further advantage of this arrangement is the insulation of the instrument circuit from the main field circuit which is occasionally liable to high transient voltages.

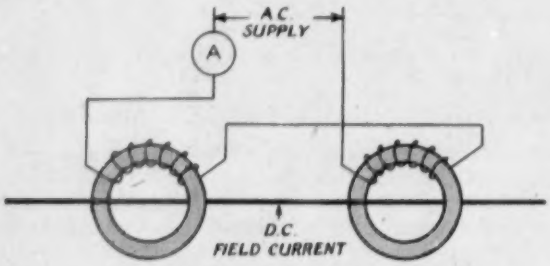


Fig. 1. Schematic arrangement of transductors on field

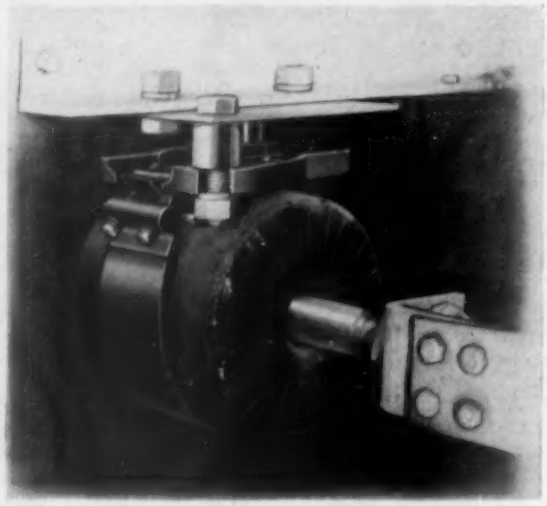


Fig. 2. Transductors installed in the field suppression cubicle at a large power station

ELECTRICITY AND PRODUCTIVITY

IMPLICATIONS for the electrical industry of plans to raise the country's standard of living in 25 years were examined last week by Professor A. Tustin, in his inaugural address as Professor of Heavy Electrical Engineering at Imperial College, London University. He suggested that it is dangerous to accept the forecast often made that progress of the order implied is more or less guaranteed by the prospect of nuclear power. To double the standard of living of the population generally, the productivity of those actively employed in production will have to rise three times making allowances for various incidental contributions. Over a 25-year period this implies an annual rate of rise of productivity of 4¼%. This has never before been attained for prolonged periods.

Professor Tustin went on to consider the automatic factory. There is an important difference between simple automatic controls and more advanced methods involving feed-back techniques. There is no physical barrier to full application of feed-back methods in industry, but in practice, this is economically worthwhile only in the chemical industry. Many so-called automatic factories which have been discussed are essentially an amalgam of automatic machines and transfer machines, and this is only an extension of existing techniques. The type of engineer required to operate them is the all-round man.

True automation can only be applied where there is mass production, and this fact has to be considered in connection with the great proportion of production carried out in this country in very small works. In spite of these difficulties, the claims that the doubling of standard of living can be secured may mean something if large advances are made in the standard of materials, health of the population and similar factors.

For the electrical industry, achievement of the 25-year doubling implies a cumulative increase in units sold to industry of 7·1% per year, Professor Tustin suggested. The point about this extremely high rate of electricity consumption is that there must be a corresponding expansion in the electrical manufacturing industry. Since the electric motor is the foundation of most industrial electrification, the expansion is particularly critical there. In this connection, there is a need for much better techniques in the selection of motors and their application. An investigation of this question has begun at Imperial College.

In conclusion, Professor Tustin remarked that in attempting to see into the technological future, he was made intensely aware of how much new knowledge is needed. The engineers who would acquire it must have both ability and training. The proportion of men with the necessary qualities is limited, and they have to fill all the senior posts in the country's economy, such as civil service and the law, as well as engineering and science. The most practicable answer to the problem of making the best use of such men seems to be to split-up the intake of students to universities so that the smallest possible spread of innate ability exists in any one class of students.

Introducing Professor Tustin, Professor R. P. Linstead, Rector of Imperial College, recalled that the Chair of Heavy Electrical Engineering at the College had been set up under the U.S. counterpart funds agreement.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Thermal Storage Heating

MR ACKERY seems to have dealt very well with Mr Green's remarks and my only reason for entering the field is that one should consider the long term angle.

As the cost of fuels rise, then the importance of flexibility in this peculiar climate of ours increases, particularly when one bears in mind that in the space of one week you can have a climate ranging from a muggy winter's day, followed possibly by heavy rain and then heavy night frost.

The great virtue of electricity is its controllability. Indeed it is its main selling point over all other fuels. You can remote control it, control it by switches and thermostats and have the heat when you want it, where you want it, and the amount you require for warmth and comfort at a touch of the switch, operation of a thermostat, remote control or time switch. Why sacrifice all these advantages for a method of heating difficult to control, particularly in a climate such as ours?

However, the main object of this letter is to support Mr Ackery's suggestion that there is a need for more data on electric heating. I think it is highly desirable that the operating costs of different methods of electric heating based on actual field tests be obtained, and we are one manufacturer who would be only too happy to co-operate in any tests which the electrical industry would like to carry out on this very interesting and important subject from the long term point of view.

A. C. Hazel,
Managing Director, (HURSEAL LTD.).

Lighting in Love Lane

IN the Tenth Annual Report of the Petersfield Society a comment on modern trends in street lighting appears:

> *"Street Lighting.*—Concern was felt by the Society at the suggestion to introduce sodium lighting at the junction of Pulens Lane and Love Lane. This lighting gives a very unpleasant light and distorts all colour. It would be most unfortunate if this type of lighting, which has been described as 'Chastity Lighting,' should be associated in any way with Petersfield. We are pleased to hear that the matter is to be reconsidered."

Apparently the people of Petersfield prefer moonlight for their courting.

E. A. Logan,
Sub-Area Manager.
NO. 3 PORTSMOUTH SUB-AREA (S.E.B.).

Faraday Lecture Acknowledgments

TO be successful any undertaking today must depend upon the united effort of a team of people. This is none the less true of the Faraday Lecture organised each year by the Institution of Electrical Engineers and I would like to take this opportunity to thank those manufacturers who have helped me with equipment for the various demonstrations:

Anderson Boyes and Co., Automatic Telephone and Electric Co., Baldwin and Francis, British Thomson-Houston Co., Clifford and Snell, Dowty Mining Equipment, General Electric Co., Igranic Electric Co., Imperial Chemical Industries, E. N. Mackley and Co., Metropolitan-Vickers Electric Co., Nash and Thompson, Oldham and Son, A. Reyrolle and Co., Ernest Turner Electrical Instruments, Victor Products (Wallsend), The Wolf Safety Lamp Co.

There are many firms missing from this list who would have helped me if I had asked them but owing to the limitations of time and space imposed by the Lecture and the halls, a selection was inescapable.

When we think of Michael Faraday in 1844 descending Haswell Colliery with his colleague Lyell the famous geologist, suspended in a basket on the end of a rope lowered in all probability by a horse gin, to investigate an explosion caused by a Davy lamp carried perhaps by a ten or twelve year old boy, we can take pride in the technical and social progress which we have made since that date.

The achievement and inspiration of Faraday have enabled the electrical engineer, backed up by a progressive manufacturing industry, to develop and make mining electrical equipment which give us a greater overall degree of safety and reliability in our mines than is to be found in any other country in the world.

B. L. Metcalfe,
NATIONAL COAL BOARD.

(In accordance with our usual practice we will be publishing an account of the Faraday Lecture following the London presentation.—ED.)

Emergency Mill Stopping

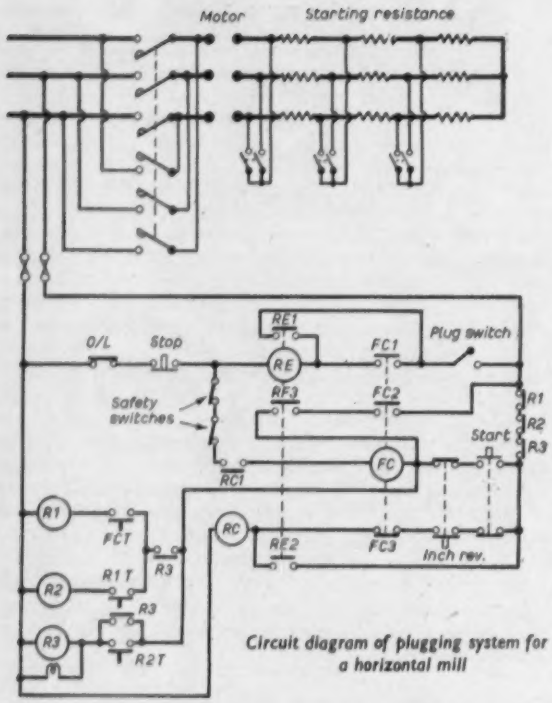
FOLLOWING the report of the paper by Messrs Cuthbert and Pisken I wish to thank you for giving such prompt publicity to a very pressing problem which is troubling all users of this type of machinery at the moment. The method described is undoubtedly the most concrete method of accessing the stopping distance of a mill, and by using only one stylus the total backing distance is recorded quickly and simply and can be measured with a foot rule (a microscope is only required to determine the deceleration curve). I feel a simplified stylus equipment should be considered an essential instrument in all rubber factories.

In my opinion the essential requirements of the emergency stopping device is absolute reliability under actual working conditions. This was not sufficiently emphasised in the paper which concluded that the best device was the electro-mechanical brake. My point was that this conclusion is only correct so long as the brake is accurately maintained. This is seldom the case. For example last week in London I was proudly shown a modern four-year-old 60 in. to 72 in. mill, but when I had the brake applied the front roll went round 3¼ times instead of ¼ of a revolution. This mill had an adequate continuously-rated automatically reset electro-mechanical brake—but . . . no maintenance! On Monday I saw two mills in different parts of Manchester which behaved in a similar fashion.

The statement that the device should "fail to safety" becomes nonsense if the device itself can become ineffective and the machine can be run under such conditions.

In the hope that you will help me to clear up the position I give below brief details of the available types of brake:

(1) *Trip Brakes* are weight loaded and held off the drum by a catch, which is released by a solenoid. Since the brakes have to be manually reset they are often neglected with the result that when needed they are often ineffective; in addition since the action of the solenoid depends on making a switch the system does not fail to safety and should the power supply fail, the brake cannot be applied.



Circuit diagram of plugging system for a horizontal mill

(2) *Continuously-rated automatically-reset brakes* are applied to the machine whenever the motor is stopped with the result that the machine has frequently to withstand considerable shock loading. The brake linings, therefore, wear and have to be adjusted to maintain their efficiency. These brakes "fail to safety" and the frequency of operation tends to clean them. The effectiveness of braking depends in the rapidity of operation of the no-volt coil of the motor starter. With the existing starters often associated with these machines it is usually admissible to replace one of the overloads with a short trip to ensure rapid application of the brake. This necessitates the use of snap-over limit switches—which do not fail to safety.

(3) *Clutch brake couplings* one usually finds are fitted between the motor and reduction gear and, in emergency, the motor is allowed to run free and a brake is applied to the rest of the machine. This reduces the energy to be absorbed by the brake tremendously and relieves the motor of all shock loading. If the unit is operated by compressed air it fails to safety and, since it is independent of the electrical supply the existing starting equipment can be used.

(4) *Plugging to rest.* Although the contactor duty is severe this is merely a matter of proper design and since the equipment is enclosed in a dust-proof case there is no chance of sticking due to accumulated foreign matter. Although in the event of power failure the motor does not plug, it must be remembered that a mill is only dangerous when it is loaded with rubber. If a loaded mill does not plug due to power failure, then the operator must have been in a safe position whilst power was being supplied to the motor. Thus, at the instant of operation of the safety bar, the mill is slowing down: firstly because the power is cut off and secondly because of the resistance of the material which is being milled.

The performance of this braking device does not deteriorate. In the event of the plug switch device failing, the motor is stopped and cannot be run up to speed until the device is replaced. The machine is only plugged to rest in emergency so that the machine shock loading is reduced to a minimum. The mill can be inched in reverse if required, whatever the position of the safety bar, so that it is possible to minimise injury due to bruising.

J. B. Young,
LONDON, S.W.1.

Fuses for Ring-Circuits

MR J. H. ROBINSON, in his letter, has seized on what is probably the only domestic appliance (fires and cookers excepted) requiring a 13-amp fused plug. In fact, I have heard complaints that certain heated washing machines, complete with agitator and powered wringer, are beyond the capacity of the 13-amp fuse. Most households in any case only possess one washing machine and surely it is cheaper for the householder to up-grade a few plugs from 7 to 13 amps instead of down-grading several plugs from 13 to 7 or 3 amps.

The comment on socket-outlet adaptors is a little unfair. The existing ring-circuit has been extended to provide 14 outlets on the ground floor and a second ring-circuit is now being installed to give 13 outlets on the upper floor. Thus the total outlets, are to be 27 (without including the kettle outlet on the cooker control unit). I am hoping that these will prove adequate to cope with all requirements without the necessity for any adaptors. Some of the appliances, incidentally, which require fused plugs are soldering irons, an electric drill, vacuum cleaner and so on, which have only an intermittent usage.

Floor area of the house concerned is 1,250 sq ft, hence the installing of a second ring-circuit.

Safety First.

"Earthing Tests"

I HAVE read Mr Stopford's communication with interest, and note that he fully appreciates the difficulty of employing direct earthing in rural areas under the new requirements; the problems he enumerates are not new, however, and there are others. Now that the struggle has become so unequal, however, I am rather surprised that anyone should still consider the use of direct earthing where driven electrodes are the only possible contact with earth, and would recommend the saving of time and money, and the achievement of a satisfactory protective system, with the use of voltage-operated trips from the start.

I do not agree with Mr Stopford that the abandonment of the earth-free situation represents a step forward in our contemplation of earthing problems. Introducing the earthed casing of a radiator into a room where no earth contact existed before is making a present to the consumer of one-half of an accident, as experience has already demonstrated.

T. C. Gilbert,
FOLKESTONE, KENT.

Science and the Board Room

"METEOR" need not wonder that qualified engineers, technicians and scientists are becoming in certain quarters unwelcome in the board room

The technician may, in a single sentence, explain some well-known law or principle of physics or chemistry that completely nullifies the effect of a brilliantly-delivered speech, that may have lasted for hours, and taken weeks to prepare.

The master of Blarney seldom appreciates correction, especially if it is given over the board-room table.

"Pole-cat."

Instrumentation for a Rolling Mill

MEASUREMENT SYSTEM PROVIDES FACILITIES FOR AUTOMATIC CONTROL OF ROLLING MILLS

ONE of the fields of current investigations into application of automatic process control is the cold rolling of steel, where considerable scope exists for the adoption of automatic control of gauge. An indication of the possibilities in this field was provided last week at the I.E.E. Measurements and Control Section, in a paper by S. S. Carlisle, M.SC., A.M.I.E.E., and G. W. Alderton, B.SC., which detailed the instrumentation involved in operating a 14 in. rolling mill and discussed the extension of this work to its control.

The mill employed is an experimental type capable of being reversed, installed by the British Iron and Steel Research Association to facilitate research into cold rolling at high speeds. Fig. 1 shows its essential features, the mill employing four rolls to enable small diameter rolls to be

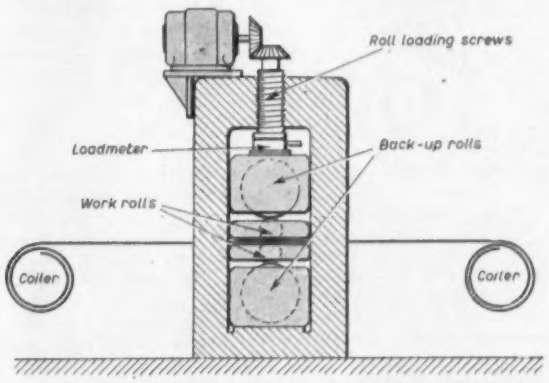


Fig. 1. Arrangement of the 14 in., four high reversible cold rolling mill

used to roll thin sheet efficiently with the large diameter back-up rolls providing the rigidity necessary to prevent roll bending. It is also equipped with suitable coilers by which appreciable front and back tension can be applied. The force applied to the rolls, and hence the reduction in gauge effected by a pass through the mill, is controlled by motor-driven screws which apply a downward force on the roll bearings.

Essential Variables of Process

Essentially, the variables in the rolling process are roll force (applied on each side of the mill by the screws), front and back strip tension, strip gauge on leaving the mill, and the driving torque at the mill rolls, the majority of which should of necessity be indicated and recorded to facilitate both operation and research. A number of methods of measurement have been developed, all using resistance strain gauges, but employing a variety of circuit techniques. These principles have been employed in the present case, but the instrumentation system has been unified, and circuit techniques developed to provide a model upon which future mill instrumentation schemes in the industry might be based.

A strain gauge bridge forms the basis of all the instrumentation schemes, enabling a common circuit technique and amplifier system to be evolved. This technique, shown in Fig. 2, employs automatic potentiometric indication in which the output from the bridge is compared with a signal generated by a linear resetting potentiometer. Any difference signal is amplified and made to drive a servo-motor coupled to the potentiometer to restore the condition of balance. The angular position of the potentiometer is thus a continuous measure of the magnitude of the unbalance of the e.r.s.g. bridge. Such a system renders the calibration independent of the gain of the amplifiers employed, with greater reliability of operation, whilst a mechanical drive of appreciable power is available to drive a large, and hence easily read, pointer which is particularly advantageous for industrial instrument displays.

Excitation of the bridge is effected with a 400 c/s supply, which not only avoids the problems inherent in the amplification of low-level d.c. signals, but gives the more rapid response that 50 c/s required for automatic control, whilst also being the accepted standard for a large number of servomechanisms. Measures are taken in the way of screening to prevent capacitive leakage current which might cause unbalance.

Basic Circuit Techniques

The circuit shown includes the essentials for measuring roll force, the bridge being in the load meter shown in Fig. 1. For strip tension measurement, the circuit is modified by the addition of a radius correcting potentiometer across the slider of the resetting potentiometer to provide a correction for coil radius, since the variable measured is the coiler-shaft torque. In the continuous measurement of strip gauge, the B.I.S.R.A. gaugemeter has been employed. This operates on the principle that the introduction of the strip into the roll gap causes elastic deformation of the mill housing, rolls and screws, and thus a continuous measurement of the roll force will provide a measure of the strip gauge, provided the screw setting is fixed. Hence, by combining a signal from a roll-force meter with a signal representing screw setting (generated in a suitable transducer geared to the screw), an absolute measure of the strip gauge can be made irrespective of the screw setting. The basic circuit is effectively that of Fig. 2 (measuring the roll force) together with a screw-setting potentiometer, the output of which is fed to the pre-amplifier in parallel with those of the bridge and resetter potentiometer. The gauge

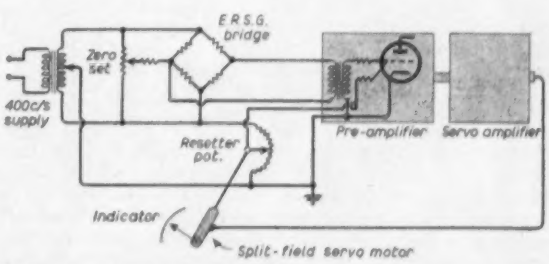


Fig. 2. Schematic of basic circuit potentiometer indicator system

meter is actually designed to indicate the deviation in gauge about a nominal value which can be set on control knobs.

The circuits of the pre-amplifiers and servo-amplifiers employed in these systems are virtually identical, their only individuality being in the voltage gain required to accommodate the different levels of input signal and in the gaugemeter pre-amplifier, where three summating resistors are required instead of two. The complete system also employs a "control unit" for each measurement channel, the function of which is the accommodation of zero-setting and calibration controls and the transformer supplying the appropriate s.g. bridge.

The performance of the measuring system is judged on accuracy, presentation of measurement, and indicator speed of response. The latter two depend on the design of the automatic potentiometer system, which also influences the overall accuracy, and this, in turn, depends basically on the linearity of the potentiometer winding, having a specific linear accuracy of 0·1%. Fixed components can be relied upon to maintain their values to within 0·1%, whilst the loop gain of the servo mechanism is sufficiently high to ensure that the motor will turn for an unbalance of 0·1%. In all, an accuracy of 0·2% is expected. The overall accuracy of the mill load meter is taken to be ± 1%, and the reproducibility better than ± 0·5%, whilst that of the tension meters will also be better than 1% when suitable modifications have been made to the radius factor potentiometer.

Accuracy of the gaugemeter is effected by differential thermal expansion between the mill rolls and frame causing a change in the roll gap not included in the measurement, which factor is still undergoing investigation. Apart from this error, the gaugemeter is accurate to the order of ± 0·001 in. whilst the roll force is to be above the 50 ton minimum to ensure linearity in the mill extension/roll force relation. Where rolling schedules are such that roll temperature changes would cause unacceptable errors, it may be necessary to use a flying micrometer or X-ray gauge to monitor and apply correction to the gaugemeter.

As already pointed out, the instrumentation system is designed to provide facilities for automatic control by a number of methods and already a simple on/off system has been applied to effect control of the gauge. This method employs a pair of cams fixed to the shaft of the gauge-error indicator and arranged to operate one of a pair of micro-switches should the gauge deviate by more than a set tolerance from its nominal value. These micro-switches actuate relays which in turn energise the appropriate screw motor contactor to raise or lower the screws accordingly. Screw drives are provided by induction motors, and to provide rapid braking when the control contactors are open-circuited, d.c. plugging is employed. Although this technique is at present in its most elementary form, stable operation of the system has been obtained with a gauge-error tolerance zone as low as ± 0·0005 in. Still further improvement may be obtained by shortening contactor operating times. However, work is in hand at present to effect a changeover to continuous control in which correction is applied proportional to gauge error, whilst consideration is also being given to automatic control of tension based on measured tension.

DISCUSSION

Sir George Nelson, Bart., President of the Institution, welcomed this new piece of research carried out by the authors on instrumentation. In his wide experience in the fields of coal, oil, steel and so on he had tried to impress the necessity for control on users. Unfortunately, they were not always prepared to pay adequately for the advantages obtainable.

Mr W. Spence (British Thomson-Houston, Rugby) said that the authors were very bold in proposing the use of such a plethora of electronic equipment. While the latter was obviously essential in the steel industry, the tendency was to regard complete reliability as the first requirement and no doubt this was the main reason for the attitude of the steel industry towards magnetic amplifiers. He hoped no one would go baldheaded for any one type of amplifier.

Mr W. N. Jenkins (McLellan and Partners) agreed that the instrumentation described was a model for industrial mills of the same class and could with advantage be applied to other types of mills. He thought, however, that the radius-correcting potentiometer would cause difficulties to many production mills and would be liable to damage by cobbles.

Mr J. B. C. Robinson (I.C.I., Birmingham) said he did not know to what extent the systems set out in the paper were suitable for production mills. It sometimes frightened him to see electronic equipment installed, apparently ruthlessly, and sometimes not too well engineered. Yet the people ultimately responsible for it were not the makers or even the designers but the maintenance staff who were suddenly asked to get the main rolling mill in action when it had gone out. The responsibility placed on them was rather heavy. He recommended alternative methods of control so that the mill could operate, even with reduced efficiency, while faults were corrected.

Mr J. F. Coales (University of Cambridge) said there was a tremendous future in on/off controls which saved the motor from running continuously for errors of no importance, if they had a "dead zone." Electronics had acquired a bad name which as a genus they little deserved. While there had been some poor designs in the past, there was no real need to have unreliable electronic equipment nowadays. The life of electronic valves could be great and experience showed that with proper precautions and proper maintenance schedules there need be no catastrophic failure. On the other hand, for those who wanted them he was assured that junction transistors now available fulfilled all the roles required of them in this type of control equipment in industry.

Dr D. Taylor (A.E.R.E., Harwell) emphasised that thermionic valve circuits could be extremely reliable if properly designed with the right components. In connection with the criticism that thermionic valves should be avoided in the control of nuclear reactors, a control system was designed some years ago without them. It was interesting that no one had bothered to use such a system, the reason being that since nuclear reactors were first used, reliability had been extremely satisfactory.

Dr G. Syke (Baldwin Instruments) thought users and the instrument-making industry had perhaps taken reliability too lightheartedly. This position had greatly improved thanks to sad experience and the educational work of the previous speaker and his establishment. Perhaps the major headaches and failures in rolling mill instruments were to be found in elements directly associated with the mill in the purely mechanical, thermal and other working conditions. They were affected by dust and dirt and knocked about by ingots. The electronic equipment, on the other hand, was nicely tucked away in the control room out of harm's way. It had no business to be the limiting factor on reliability. Elements built into the mill might be a weak point in the gauge control system.

Mr T. W. Hood (Robertson and Co., Bedford) said there was a growing demand for a simple, reliable, workable system of automatic gauge control which did not cost too much. Experience suggested that while such a device might be valuable in rolling accurate strip, act as a doctor if the hot rolled strip was not very good and, in general be reliable, the smaller firms who could not carry an electronic expert on their staff fought shy of it. He would put in a plea for simplicity and cheapness without too much sacrifice of accuracy.

Mr J. I. Bernard (E.D.A.) observed that he found the equipment impressive. Experience amongst users showed conclusively that electronic control was most satisfactory. Admittedly this applied to the larger firms who had staff trained for the necessary maintenance work, no doubt. He thought doubts arose almost entirely with people who had had no experience of it. It must be well engineered; one could not have flimsy gear and enclosures in industrial plant.

notes on wiring

by Megohm

IN my Notes dated 1st December, 1955, I dealt briefly with the report on Fatal Domestic Accidents, recently issued by the Home Office. I have studied this report very carefully and find it rather grim reading. The report points out the list does not necessarily represent the total of such accidents, and only the bare details of these are given. I should like to see some details of the inquests on the accidents added to this report, for I feel that too little is done at these inquests to point out the dangers of bad wiring, etc.

Appliances in Use

The vacuum cleaner is today considered essential in the home, yet this aid to housework can be a source of danger if wrongly connected. A housewife was electrocuted whilst using such a cleaner when she touched a fireguard attached to a metal grate. The flexible lead from the cleaner had three cores but was fitted to a two-pin plug to which was attached a bayonet-cap two-pin adaptor, so that the cleaner could be used from a lampholder. When the connections in the plug were examined, the green earth core was found to be twisted together with the red-core and connected to one of the terminals. By having this faulty connection it was, of course, possible for the metal-work to become alive each time the contact of the adaptor connected with the live side at the lampholder. The report goes on to say that the lady had complained of receiving a shock on a previous occasion, but no action had been taken in the matter. I myself meet people who admit receiving shocks from certain apparatus but "do nothing about it." They are more fortunate than some. Although most apparatus sold today has a label attached to the green earth core, many people are still quite ignorant of the use of this core. People cut it off, or leave it hanging outside the plug.

Apparatus of the "improvised" type continues to be a source of danger. I mentioned certain cases in my previous Notes, and I think it worth while to comment on a further case. A keen gardener had "rigged up" a heater in his greenhouse. This consisted of a spiral type element with a wire from each end connected to a lampholder adaptor and this was plugged into a portable handlamp suspended from the roof. The supply to this portable lamp was taken from an outside lavatory where the switch had been connected in the neutral. The unprotected element was, therefore, continuously alive and the man's head came into contact with it and he was electrocuted. Here, of course, the dangers of the improvised equipment were increased by the wiring installation in the lavatory. A fatal combination of bad electrical engineering and improvisation.

Children too have been killed by faulty apparatus. At this season of the year we feel such accidents even more. It would help if everyone looked carefully at the electric fires which have been brought into use now, the cords to the table lamps, etc., and those decoration lamps which are being made ready for the festivities. I for one shall be making sure that my friends are told of the dangers.

Portable Lights and Apparatus

A portable handlamp is a boon in the house. Those trips into the loft to see to the water tank which you meant to insulate during the summer; that crawl under the car in the garage and all the other little awkward jobs are much easier done with the aid of a good light. But here, again, danger lurks if the equipment is wrongly or badly connected and in a bad state of repair. A young plumber was electrocuted by a handlamp whilst working on some pipes in a passage under a floor. The handlamp was of metal construction of the clip-on pattern and wired with a three-core t.r.s. flexible. Part of the cable was wound on a drum, one end being connected to a three-pin plug for connection to the main and the other end connected to a three-pin switchsocket on the drum. The accident was due to the earth conductor in the plug attached to the lamp extension being bare and some of the strands coming into contact with the live conductor. The metal grip of the lamp became alive. The earth wire had been pulled clear of the connection of the plug. In addition the switch fitted to control the outlet on the drum had been connected to the neutral. Here again is a combination of faults which should, and could, have been located before such a tragic event happened.

Another instance of the switch being connected in the neutral of a switchsocket is that in which an elderly lady was electrocuted. An electric fire was connected to the three-pin socket-outlet and the switch was in the OFF position. The lady started to dust the fire and received a fatal shock when she touched the elements.

Defects in Design

One death is reported under the above heading and this was due to an unearthed and defective vacuum cleaner. The cleaner was fitted with a two-core flexible and lampholder and had been plugged into the kitchen lighting point. An examination revealed that one of the leads had become trapped between the metal casing of the motor and the handle and that the insulation had been cut. The woman was found with the cleaner between her legs, clutching a gas cooker with one hand and with the supply still switched on. Good-class apparatus is always supplied with a three-core flexible lead, but of course, the absence of a proper outlet defeats its purpose. The matter of providing proper outlets in useful numbers has been troubling many of us for some time now. The fact that fatal accidents occur because of this should spur everyone on to push home this point whenever possible.

Of all the causes of fatal accidents, faulty wiring is perhaps the one nearest to us. Every so often we come across evidence of the "unskilled," and I personally never cease to be amazed that the deathroll is not higher. I have read about, and seen, many instances of the amateur at work. Much of the bad wiring is "concealed" and the victim knows nothing until he comes across it and, very often, knows nothing more.

Seen at Smithfield

Some of the Equipment which aids the Stock Farmer and the Grower

EXPORTS of agricultural machinery in the first ten months of this year amounted to over £57m of which £41½m were tractors, so it is small wonder that some 1,570 visitors from overseas were amongst the 72,250 that visited this year's Smithfield Show in Earls Court Exhibition Building last week.

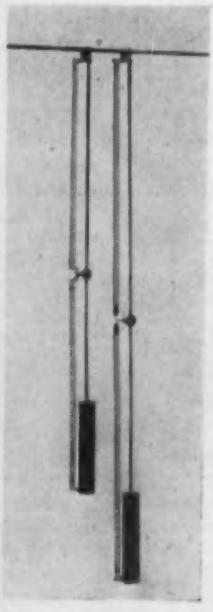
No doubt to the agricultural community the livestock competition was the prime attraction but the three hundred and seventy trade exhibits all reported good business. Amongst the exhibitors who booked space in the ground and first floor sections were many who are well known in the electrical industry.

The E.D.A. display this year was devoted to crop drying and barn equipment; features were the in sack and in silo grain drying equipment by G.E.C., Modern Appliance and Equipment Co. and others.

Lighting to Aid Potato Chitting

The General Electric Co., who occupied a stand on the first floor took advantage of the occasion to introduce a new fluorescent lighting fitting specially developed for use in seed potato chitting houses. Seed potatoes are frequently stored in trays stacked in glass potato chitting houses and one disadvantage which worried G.E.C. agricultural experts was that whilst it was possible to install heating equipment to keep out frost it was nevertheless impossible to limit the temperature rise during warm weather. Consequently the temperature in the house varied over wide limits. An alternative method is to use well constructed buildings for the storage of seed potatoes. These buildings can be insulated against high outside temperature, and under suitable conditions can be kept between 34° and 42° F by ventilation. Above 40° F the potatoes will develop shoots and then adequate lighting is essential to encourage the growth of the right kind of shoots. G.E.C., therefore, have developed two special lighting fittings for this use. They comprise two fluorescent tubes mounted end to end and hung vertically between stacks of trays from overhead conduits. The control gear is fixed to the bottom of the fittings and the whole assembly moves easily along between the rows of trays as required. Light emitted by the Osram New Warm White tubes encourages the growth of short sturdy shoots ideally suitable for planting. Two lengths of fittings are available, one with two 5 ft 80 W tubes and the other with two 4 ft 40 W. Needless to say this introduction was supported on the stand by examples of the grain and crop driers, infra-red heaters and sterilizing equipment for which the firm are well known.

Below, is the new Purlac Milk Cooler, and right, G.E.C.'s Potato chitting fluorescent units



Special Agricultural Motor Design

From the British Thomson-Houston headquarters at Rugby are two new items. First is a 1½ h.p. capacitor start motor specially developed by B.T.H. for agricultural use and the other an advanced design of infra-red heating unit for rearing pigs and poultry. The new motor incorporates many of the design features of other B.T.H. fractional motors. The new motor has a frame of the same size as some of the larger f.h.p. motors but is uprated by 50%. In order to make installation in milking machines, elevators, etc. an easier proposition, B.T.H. have made the starting capacitor an integral part of the machine. The motor itself is suitable for normal 200/250 V a.c. supplies. The infra-red heating unit has already made its debut. It is a 300 W Pyrobar dull-emitter sheathed wire element fitted to a standard e.s. cap. An 11 in. diameter burnished aluminium reflector has the standard e.s. holder to take the element and is coupled to 6 ft of cable and 5 ft of suspension chain.

Other equipment included a number of agricultural machines in which B.T.H. electric equipment is fitted, the "Stavolt" engine driven generating set and Mazda Lamps and lighting equipment for use in farm buildings.

E. H. Bentall of Maldon, Essex, introduced a unique design of automatic mill. Their "Mini-Wizard" has been designed for the smaller farm and poultry keeper. By incorporating a 1½ h.p. motor, which can be supplied by a normal lighting plant, the firm believe that a far greater number of farmers will be able to enjoy the ease of automatic grinding. Output figures they say have proved that grinding through a ¼ in. screen and assuming power costs at 1d. a unit, one ton of wheat can be ground for approximately 1s.—an impressive saving. Test output of wheat through a 1/16 in. screen was 168 lb per hour.

Purlac Ltd. claim to have the smallest ever in Churn Milk Coolers with an output of 30/35 gallons. This they have produced by adapting one of their trays, 3 ft x 2 ft, to take one churn and the sealed cooling unit. The churn, they say, is cooled in 10 minutes by their inchurn method. Price of the machine, £99, should attract the small producer.

E. R. and F. Turner Ltd., who are the parent company of Bull Motors Ltd., returned to the Smithfield show for the first time since 1932 and featured three examples of

Above, The Tarpensaw; top centre, the streamlined Swift slicer, and right, Bentalls' new Wizard mill, are mentioned in the text; A recent introduction however, bottom centre, is this new Fencer Battery by Lucas

their agricultural machinery and equipment. The grain and seed cleaner is powered through their patent monoplane drive which imparts a reciprocating movement. Unlike most cleaners, cleaning of the screens is done by brushes which move laterally across the undersides in a direction transverse to the oscillatory movement of the sieve. These brushes are operated by a roller rotating on a round bar. The Junior batch mixer exhibited was made in two models, 10 cwt and 20 cwt. On the motor driven type a large V rope pulley is mounted on the upper end of the worm shaft and is connected by "V" belts to a suitable pulley on the motor. The motor mounting is adjustable to allow stretch in the belts to be taken up. Starter control is mounted conveniently on the side of the frame. Only 25 minutes is taken in loading, mixing and sacking off each batch with the 10 cwt model (material at 24 lb per cu ft).

Alvan Blanch Developments junior version of their "Cascade" grain drier was new at the show. These "Cascade" grain driers can be electrically driven or from power take off. The bed is not made of perforated metal but of overlapping louvres. From Adams and Benson (Dalbukirk) is now available the "AB" electric fencer unit and accessories whilst an unusual method of cleaning eggs, the "Cleanegg" method, introduced by Agricultural Books Ltd. comprises the use of a compound which is applied by rotary brush either fitted in the chuck of a power hand drill or in a special assembly. This method is said to dry clean eggs at a rate of 20 dozen per hour. Wicksteeds of Royston, Herts, showed what will prove most attractive to all who have an interest in the land, especially those whose interest is recreational—their "Joy" electric motor sets for converting roller-type lawn motors to electric drive.

Moisture Measurement

There were four interesting new items displayed by Scottish Mechanical Light Industries. The Scotmec Oxley instantaneous moisture meter can measure the moisture content of any grain either in bulk or sacks. It uses an insulated contact head which has nine stainless steel probe electrodes, a hand generator puts out a 500 V current and resistance between the electrodes is measured by a specially calibrated ohmeter giving direct percentage reading. Scotmec "Popular" hammer mills, 2 h.p. to 8 h.p., are now mounted on mealchests for automatic operation. The chests also serve as packing cases. Latest development is the "Wee Smasher" hammer mill which has a built-in 7,000 r.p.m. motor rated at ¼ h.p. so that it is suitable for almost any power plug. It is a complete grinding outfit with a low-level feed hopper, unchokeable feed and small multibagger collecting the meal direct in bags.

Tarpen Engineering displayed the new "Tarpensaw," a portable electric chain saw weighing 14½ lb but nevertheless robust. It is ideal for tree felling, pruning, topping, and can handle up to 10 in. diameter wood. Incidentally, the motor unit is the same as that used in the "Tarpentiller," each machine being convertible to the other. The "Tarpentiller" is, of course, used for tilling where a row cropping machine cannot be used.

Black and Decker, the tool people, exhibited a complete range of portable electric tools for the manufacture, maintenance and repair of all types of motor vehicles and farm machinery. New products included their 7 in. heavy duty sander-grinder and a 6 in. portable grinder incorporating a new design of motor.

Butchers' equipment is appropriate at the Smithfield Show. Swift and Swallow have a new model 32 mincer with a very much higher output whilst new features are apparent in the Swallow electric gravity feed slicer which makes it more streamlined in appearance. This firm have also introduced a new semi-automatic scale giving all-round vision on a turret type chart. It is primarily intended for pre-packaging, is self levelling and can be read from any angle.

Geo. W. King, of Stevenage, included in their display their "Cyclonic" mobile grain conveyors. These are high pressure fans, driven by an electric motor, supplied complete as mobile units on heavy steel frames on rubber tyred wheels. Capacity of these units approximates 2-4 tons per hour. There were also examples of their electric pulley blocks and tackles, the "Mytemin" and the "Matom."

The Lister display included a range of diesel generator sets with ratings from 1·5 kW to 40 kW pumping sets, cream separators, butter churns, sheep shears, and horse and cattle clipping machines, amongst them the new "Premier" electric clipper for 230/240 a.c./d.c.

In refrigeration, the name "Prestcold" is pre-eminent and so was their display which, amongst the full range of refrigerator models and equipment, included the new SC 131 service cabinet which gives large internal capacity on a small floor area. Incorporating a frozen food locker the SC 131 was shown fitted with hanging rails suitable for the meat trade.

Direct Butt-Welding of Steam Pipes

DEVELOPMENT work on the Burton pressure butt-welding process, began in 1947 at H.M. Dockyard, Rosyth, and has now reached a stage when it can be considered as a commercial proposition. The patent covering the process is owned by the National Research Development Corporation and the task of producing a machine for industrial use is being carried out by Metropolitan-Vickers Electrical Co., Ltd., under contract to the Admiralty.

Preparation work consists of producing a fine machined bevel finish with mating faces on the bore of the two pipes to be joined. The faces are then brought together under a minor load, applied by hydraulically operated clamps, and the join is heated by a multijet oxy-acetylene ring burner until a preset thermal expansion, longitudinally, has been reached. A second higher or control load is then applied to restore the pipes to their original length, and this butting pressure completes the weld. All sequences are controlled by limit switches which also automatically cut off the gas supply just before completion of the weld. The welding temperatures are not measured but may be systematically varied by alteration of the control pressure; raising the pressure reduces and lowering increases the weld temperature.

Two practical machines have been built: the Portsmouth shop machine which by the use of different size ring burners and collet holders has been constructed to weld pipe to pipe and pipe to flange in sizes from 3 in. to 8 in. o.d. for wall thicknesses between 3/16 in. to ¼ in., and a portable machine for 1¼ in. to 2½ in. o.d., and ¼ in. wall thickness. The larger shop model can be adapted as a transportable machine.

Welding has been confined to mild, carbon-molybdenum and chromium molybdenum steel pipes, but there does not seem to be any reason why more highly alloyed pipe steels cannot be joined by this process. Post-weld heat treatment is a requirement and consists of normalising for mild steel pipes and normalising and tempering for low alloy steels where air-hardening tendencies are present. Straight normalising may be carried out on the machine but tempering heat treatments require separate equipment.

The process is fully automatic and apart from the necessity of ensuring correct setting of the machine and occasional consistency checks, highly skilled operators will not be required. Apart from pipe welds, the process appears to possess potentialities in the fabrication of other highly stressed components such as gas cylinders and small pressure vessels.

The patent development was originated by Mr J. E. Burton, a Dockyard Technical Officer, who has been appointed as technical adviser on the development of the process on the machines that now bear his name. Enquiries regarding licences under the patent should be addressed to the Exploitation Officer of the National Research Development Corporation at 1 Tilney St, London, W.1.

TECHNICIAN'S CERTIFICATE

PROFESSIONAL engineers and craftsmen are clearly defined and catered for in the technical educational system of this country. Filling the wide gap between them are the technicians. In recent years there has been much concern with the provision of facilities for training and of appropriate qualifications for this important class of engineering worker. The most recent indication of this has been a Conference on Courses for Electrical Technicians, which was organised by the Institution of Electrical Engineers early this month, with Sir George Nelson, Bart., in the chair. There was an attendance of nearly 250 interested engineers and educationalists.

This was the third conference convened by the I.E.E. since it drew attention to the problem in 1953. Since the last, the City and Guilds of London Institute has drawn up regulations and syllabuses for the conduct of suitable examinations, and the main purpose of the recent conference was to publicise the scheme.

Under the new scheme, Technician's Certificates will be offered for those engaged in the design, manufacture and testing, erection, operation and maintenance of electric plant. Specific subjects covered initially will be plant and machinery, power generation and supply, and industrial electronics. Later, it is hoped that additional courses will be developed to meet the needs of the industry.

Arranged to extend over four years, the new course is intended for students attending college for one day a week or for three evenings a week. Subjects covered in the first year include electrical engineering principles, engineering materials and drawing, practical mathematics, and technical reports. Third and fourth courses will be more specialised depending on the employment of the student. It is possible that colleges may develop courses and examinations in a special technique for the fourth year, according to local requirements. Those successfully completing a course, and then obtaining further passes in two special techniques at higher level will be eligible for the Institute's Full Technological Certificate, which will be endorsed by the Ministry of Education. The Electrical Technician's Certificate itself will be endorsed by the I.E.E., and usually by an association concerned with technicians.

The conference to discuss this scheme heard first of all Mr M. W. Humphrey Davies, who is chairman of the City and Guilds committee concerned with the new course. He indicated that the scheme placed less emphasis on mathematics and more on the practical aspects of electrical engineering than the National Certificate course. This was also the theme of Mr C. Grad, Education Manager of the B.T.H., who spoke on behalf of industry and expressed the ready support which industry would give to the course. Problems of organisation which the new course posed for technical colleges were discussed by Dr J. E. Richardson (Northampton Polytechnic) and Dr J. S. Tait (Woolwich Polytechnic). They felt, however, that availability of the course would enable students to be guided more effectively in relation to their future work.

The final speaker in this official introduction was Dr Willis Jackson, who spoke as chairman of the responsible I.E.E. committee. He made the point that National Certificate courses would remain a route—an arduous one—to professional status, while the Higher National Certificate in Electrical Engineering in its own right would continue as an appropriate qualification for many high-grade electrical technicians.

A short report drawing attention to the courses for technicians has been published by the I.E.E., price 1s.

INDUSTRIAL MAINTENANCE

Steelworks Electrical Department

ELECTRICAL ORGANISATION AT JOHN LYSAGHT'S OF SCUNTHORPE

CONTINUOUS operation, temperature extremes and a dust-laden atmosphere are amongst the conditions for which the electrical department of a steelworks has to plan. It is also likely to be responsible for a private generation programme based on the fuels that become available in the course of steel-making. All these conditions apply at the Normanby Park Steel Works of John Lysaght Ltd., at Scunthorpe, which we were privileged to visit recently. The maintenance system which serves the works manages to achieve the very low electrical-fault delay rate of 1½ minutes per shift average in the single rolling mill which the works operates.

The works is laid out for a nominal output of 10,500 ingot tons per week of semi-finished steel. Processes incorporated extend from mining and preparing local iron ore, through iron-making in blast furnaces of 7,000 tons/week (with an associated 8,000 tons/week coke oven plant) to steel-making in a shop having eight 120 ton fixed furnaces, a 180 ton tilting furnace, and two active hot metal mixers. In the rolling mill section there are twelve soaking pits to supply the two-high 42 in. blooming mill. Associated with the blooming mill are a deseaming machine, a bloom shear capable of cutting up to 144 sq. in. of hot metal and a six-stand 19 in. continuous Morgan billet mill with a flying shear at its end capable of cutting up to 16 sq in. of hot metal at delivery speeds between 250 and 630 ft/min. A rod mill with an output of 3,500 tons/week consists of a reheating furnace and a 19-stand mill. It produces rod in sizes from 5 gauge to 9/16 in. diameter.

Electrical requirements of this plant are looked after by a staff of about 200, under the control of the chief electrical engineer. There is an assistant engineer, two junior engineers and a small electrical section in the general engineering services drawing office. Power station staff are grouped under a power station superintendent, while the works generally is divided into five sections with day and shift men under section maintenance engineers. As will be explained later, the policy here is to give clearly defined responsibility to all members of the electrical department. Finally in this summary of the electrical department organisation, three central services, each under separate supervision, must be noted: there is an electrical constructional force, a central electrical repair shop, and an instrument section.

Electrical System

Total installed h.p. of electrical machinery in the works totals about 50,000 and the works maximum demand is 18 MW. This demand is met approximately equally from works generating plant and from the Yorkshire E.B. public supply, with which the generating plant operates in parallel. Fig. 2 gives an outline of the works h.v. system. Supplies are taken at 33 kV, and primary works distribution is at 3·3 kV via a number of dead-end feeders and two ring mains, the latter being operated open.

33 kV switchgear is arranged as a single busbar switchboard consisting of ten Ferguson-Pailin VSRP 32 switches, including two bus-section switches. Two 10 MVA transformers feed 3·3 kV to the rolling mill area, two 5 MVA transformers the power station busbars, and further 5 MVA transformer the rod mill. Cables throughout are p.i.l.c.s.w.a.

In the rolling mill, a single busbar 3·3 kV air-break switchboard is installed to feed at that voltage the Ilgner set associated with the blooming mill, the 4,000 h.p. billet mill motor and the flying shear m.g. set. There are also suitable transformers and rectifiers to give the 440/250 V a.c. and 500 V d.c. supplies which are standard around the works.

So far as possible, contactor gear for the many motors is grouped as convenient in contactor houses for reasons of accessibility and cleanliness. This arrangement is not, of course, possible for the motors associated with the 44 gantry cranes.

The works dates from 1912 and in some of the older sections of the plant motors and control gear from a number of manufacturers are in use. Present policy is however to standardise all electrical equipment within the ranges of a small selected number of manufacturers and this policy is implemented on all new works.

The 33 kV switchgear, as already mentioned, consists of oil circuit-breakers of 500 MVA capacity, fitted with arc control devices; the 3·3 kV switchgear is generally of the 150 MVA air-break type, although there are one or two switchboards having oil-immersed gear of the same rupturing capacity. For main 440 V switchboards, 25 MVA air-break switches are installed, and for sub-distribution boards combined fuse-switches are used incorporating category 4 (25 MVA) h.r.c. fuses. Cabling, as already mentioned, is usually p.i.l.c.s.w.a., but a certain amount of armoured v.r.i. is used for runs on racks, while for short runs of multicore cabling some lead covered and armoured v.r.i. is run underground. In this connection, the difficult ground conditions of the works from the corrosion aspect need to be borne in mind.

Lighting is an important section of electrical department responsibility. In the main sections high bay mixed tungsten and uncorrected mercury lighting is used, with access from catwalks. The lighting supply is by p.b.j. conductors, and the entrances to the catwalks are kept locked to keep out unauthorised persons. For outside lighting on the works roads, sodium is generally used, because of its high luminous efficiency, and because the lower current requirement for a given level of illumination eases voltage drop problems.

Generating plant in the power station comprises two 5 MW h.p. turbo-alternators and three 2·5 MW l.p. turbo-alternators. These are connected to a 32 panel double-busbar air-break 3·3 kV switchboard, which is also supplied from two 5 MVA transformers. As shown in Fig. 2 outgoing feeds from this board supply all sections of the works except the rolling mill area. Operation of the power station is discussed later in this article. Here it is only necessary to note that the h.p. sets are essentially throttling devices between high pressure and low pressure works steam supplies, and that the main purpose of the power station as a whole is not to generate electricity but rather to operate the blowers for the blast furnaces.

Maintenance

It has already been stated that for maintenance purposes the works is divided into five sections each under a maintenance engineer. These sections are rolling mill; power station; blast furnaces; steel plant and coke ovens; and sinter plant and ore handling. For the present purposes, the operation of maintenance in the rolling mill area will be taken as representative of the system operating throughout the works.

Fundamental to this system is the belief that the average person is most efficient when indulging an intrinsic sense of effectiveness The application, demonstrated by the exercise of initiative in carrying out routine inspections, the swift rectification of breakdowns occur-

Drive		A.C./D.C. H.P.	R.P.M.
Rotor Resistance Ohms	Maker		Type
Stator Resistance Ohms	Maker		Type
Controller Maker	Type		
Limit Switch Maker	Type		
Brake Shunt/Series Maker		Type	Voltage
Panel Maker	Type		
Coil references			
Contact references			
Resistance references			
Relevant Drawing Numbers			

Fig. 1. Four forms of this design make up each drive record card. There is provision on the reverse for a log of maintenance operations on the drive

ring during the shift and a record low down time of 1½ minutes per shift, is the justification for this belief.

Each shift is under the control of a shift charge-hand, who at the end of his period of duty makes out a report giving details of gear which has been overhauled and breakdowns which have been rectified. There is special provision for a specific statement of any defects not cleared by the end of the shift.

Information contained in these reports is treated in three main ways. It is first displayed in the section engineer's office on a wall chart which has a separate line for each main drive in the section, and a vertical division into shifts. Symbols are limited to three, and the charts are not crowded. A square denotes an inspection and routine overhaul, a diagonal stroke a fault which has not affected production, and a red cross a fault entailing loss of production. Any "red cross" stoppages are further noted on a separate bar chart which shows total time lost, and is the ultimate standard by which the effectiveness of the section maintenance is judged.

The main chart will quickly show if too little attention is being given to a drive, with consequent increased frequency of breakdown. Similarly, it shows up any unduly troublesome piece of equipment, and signals the need for further investigation into its design and working conditions. A separate subsidiary chart is used for recording changes of carbon brushes.

Information for the chart from the continuously manned motor rooms comes from more formal report sheets which provide metering data, a schedule of stops and starts and bearing temperature records as well as a maintenance log. The bearing temperatures are again plotted visually and displayed in the electrical section foreman's office. The value of such curves in showing up any gradual deterioration is self-evident.

The second use of the shift charge-hand's report is to serve as a basis for the daily and weekly reports which are sent from sections to the offices of the chief electrical engineer for information. Daily reports are factual summaries of work carried out, and are essentially transient in nature, but the weekly reports take the form of a typed record of the week's electrical happenings in the section, and provide a continuous history of the plant that has a special value when the performance of equipment or the practicability of new ideas comes to be assessed.

Finally, any troubles recorded in the shift electricians' reports find their way on to drive and motor record cards. Drive cards assemble together information of all the control equipment connected with the motors, etc., that go to make up a main drive. Details of associated resistors, controllers, brakes, coils and contacts are all included so that arrangements for spares are simplified. On the back of the card, which is a 14½ in. x 9½ in. document providing for four drives, there is space for a maintenance log, so that the history of the "electrics" of a production machine is conveniently assembled in one place.

Each electric motor has a card to itself, and on this card is recorded all relevant details of brush types, bearing numbers and rating, as well as a note of all the drives for which it is suitable. Once again, there is ample provision for a maintenance log, and also for a history of the motor's movements about the works. The card accompanies the motor on any moves, even into the central repair shop.

When a stoppage does occur, the shift electrician at once attends. His intimate knowledge of the plant speeds fault location. The aim is to have, as far as possible, a spare motor in the section stores, complete with coupling for all drives in the section.

Generally speaking the section electrical engineer has responsibility for ordering all routine spare parts subject to the concurrence of an order office within the department which functions to co-ordinate all sections, prevent duplication, and to progress the state of the order at all stages.

Each section has workshop facilities in which routine repair work can be undertaken, but anything in the nature of a full overhaul is a task for the suitably equipped central workshop. This has facilities for all necessary repairs and overhauls except motor rewinding. It is not considered economic to train and employ armature winders with the wide range of experience called for by the varied types of motor installed, nor to keep the large stocks of copper which would be necessary. The central repair shop does, however, give a full test to motors which have been rewound, when they return to the works. Full details of the work carried out and the test results obtained from a repaired motor are entered on a special card.

The main shop in the repair department is equipped with a welding plant and drilling machines, but any work outside this capacity is carried out by the main fitting shop or boiler shop, as appropriate.

The test bay has facilities to allow the testing of a.c. and d.c. motors up to 100 h.p. and is capable of repeating the full range of tests usually applied at the manufacturer's works.

When the need for major overhauls or repairs is revealed by the reports coming to the offices of the chief electrical engineer from the section foremen, special arrangements are made to fit the work in with the capacity of the central repair shop and the programme of the production departments. The central repair section is under the control of a foreman and assistant and consists of 13 electricians and mates.

Instrument Section

Apart from the common service provided by the central repair shop there are two ways in which the sections are not self-contained electrically. One is in reference to instruments, and the other to major constructional jobs.

The instrument department exists to give special attention to all instruments, electrical, gas, steam, oil and water, used throughout the works. The reason for its existence may be traced to the ever increasing need for instrumentation of flow, pressure and temperature, associated with the systems of process control in force in an iron and steel works. So far as the electrical instruments are concerned, the section is responsible for the accuracy of all kWh metering, a matter which is of importance in the interests of internal accounting; in addition, calibration of any type of indicating instrument is carried out by this department to meet the needs of the works in general.

The department also undertakes all commissioning tests associated with new electrical installations; where such commissioning is reserved by the manufacturer (which is extremely rare) the members of the department are present to check the test results.

The instrument department is organised under its own engineer and is directly responsible to the chief electrical engineer. It is equipped with a standard

wattmeter as its basic reference instrument and with a number of subsidiary calibrated instruments. A meter test panel of commercial design provides for all a.c. tests, while sufficient current for all d.c. purposes is obtained from an old plating generator specially adapted to the purpose. For tests on site, there is a rotating substandard.

Kilowatt-hour meters are to a large degree self-checking. All meters are read at monthly intervals, and any excessive discrepancies between final meter totals and the readings of substation meters indicates loss of accuracy somewhere. When the cause is traced, the faulty meter is replaced and corrected. A series of log cards are kept to record the work carried out on each meter, and these are flagged to show the date of the last test and calibration. The meter longest in service since test is naturally suspected first when some discrepancy is found.

In addition to dealing with measuring instruments, the instrument section has responsibility for all protective relays on the high voltage distribution system. A programme is in force for the testing and checking of relays, and since it was established, there has been no case of incorrect operation of protective gear.

Other tasks given to the instrument section include care of all special test instruments held on a works basis, e.g. Ductors and stroboscopes, and maintenance of the electronic gear installed, which is at present mainly employed in the field of communication, and certain monitoring devices.

Construction Force

The constructional field force consists of a foreman and charge hand, 18 electricians and mates and 7 general labourers for cable work. Its existence means that contractors' men are effectively eliminated from the job in the works. It is considered that this direct labour approach to new construction is probably cheaper than the contractor system, but in any case the existence of the constructional force is justified from other considerations.

The first of these is the emergency pool of experienced steelworks electricians made available in the case of serious trouble on the electrical plant which strains the capacity of the sectional maintenance organisation. There have been several occasions of this kind where the constructional staff has proved invaluable. Further, the force can be organised so as to have a high load factor of work. Although its work is normally less urgent to some degree than that of the maintenance sections, it is possible for men to be borrowed from the maintenance organisation for peak tasks in an installation project. The resources of the construction party are such that they are capable of undertaking work of quite appreciable magnitude. Two examples may be quoted.

The construction force have recently completed all the electrical installation work associated with a new blast furnace, comprising the hoist gear, clay gun, scale cars, general internal and external lighting and the complete system of communication and instrumentation cable work. Work at present in progress includes the erection of 1¼ miles of 11 kV overhead light line, the installation of a new ten panel 3·3 kV switchboard and all the associated cable work involved in the transference of load from an old switchboard to the new installation.

It is considered that work of this nature represents roughly the largest size of job which can justifiably be undertaken by a works constructional staff and if for example a new rolling mill were to be installed involving major cable and conduit installation, then a contractor would be employed.

Maintenance Techniques

In general the maintenance sections follow well established techniques, modified as necessitated by the special conditions of steelworks operation. An example of this is the lighting. In the main bays, lighting is provided by pairs of 1,000 W tungsten and 400 W uncorrected mercury vapour lamps, fitted with Holophane reflectors and located high in the roof. Without ready means of access these would soon deteriorate, and the light intensity at working level, an important production consideration, would fall off. The lamps are therefore fixed on davits on each side of a catwalk, and one man is allocated as a lighting maintenance attendant. He is not an electrician, but is authorised to clean and change lamps. Lamps, all of which are individually switched and fused, are left in position until they burn out. With the ready access available, group changing schemes are not considered worthwhile. Periodical photometer surveys are carried out to ensure that illumination remains at a satisfactory level. It has to be borne in mind in considering this system that the cranes are not available for lamp work because they are essentially production tools.

Another way in which the special conditions are taken into account involves the 500 V d.c. supplies; these are afforded via a two-wire unearthed system. The d.c. cranes are the particular items of equipment which are liable to develop earth faults, generally due to failures on the cross travel collector gear. In order to assist in fault location, earth indicators are placed at frequent intervals throughout the works so that in the event of an intermittent fault developing, the electrician may, by simultaneous observation of the cranes and earth indicators, determine on which particular item the fault is occurring.

System Operation

Keeping the equipment in running order and providing for new plant is only part of the electrical department's task. As already mentioned, it has responsibility for operation of an electricity supply system around the works which involves parallel operation of the public supply and turbo-alternators in the works' power station.

The power station uses the low calorific value blast furnace gas to raise steam for all works purposes, but primarily for operation of the turbo-blowers which provide the blast for the furnaces. Since the supply of gas is substantially in excess of the requirements for this purpose substantial amounts of steam can be used for electrical generation purposes.

Steam raising plant in the power station consists of three high pressure boilers each rated for 80 klb/hr at 625 lb/sq in., 800°F, and three 30 klb/hr low pressure boilers, raising steam at 160 lb/sq in., 535°F. In addition there are ten waste-heat boilers associated with the steel plant furnaces which raise steam at the same low pressure conditions. The high pressure boilers can fire blast furnace gas or oil, and if it is available, the higher calorific value coke oven gas. The low pressure boilers also fire blast furnace gas, with coke breeze as an alternative.

Generating plant has been described earlier. It is operated to balance the pressure on the high and low pressure steam systems. In addition there are two turbo-blowers supplied from the h.p. steam main, rated at 65,000 cu ft of free air per minute at 18 lb/sq in., and two further turbo-blowers giving 35,000 cu ft of free air per min at 12 lb/sq in.

The distinguishing feature of John Lysaght's as opposed to many other steelworks is that all this plant is operated under a shift control engineer whose responsibility directly corresponds to that of a shift charge engineer in the electricity supply industry.

The shift control engineer co-ordinates the activities of the fuel, feed water, boiler plant and turbo-alternator operators in maintaining a balance of the controlled quantities. Maintenance of turbines and boilers is the responsibility of a different department.

The shift control engineer is invariably electrical in training, and outside day work hours acts as the senior electrical engineer on the works in the event of any fault.

Operation of the power station is complicated by the unpredictable variation in the supply of blast furnace gas. The variation comes from the loss of gas when the blast is shut off for some reason. On some occasions only a few minutes warning is available of such a change. The shift control engineer can change over the l.p. boilers to coke breeze firing in about half an hour, or can change to oil on the h.p. boilers in a very few minutes.

Electricity is used for pumping the water used in the works, and this is a service that has to be specially well safeguarded. The water is used for cooling many parts of furnaces exposed to high temperatures, and loss of a supply may cause serious damage.

Fig. 2 shows the general arrangement of the works 33 kV and 3·3 kV system, and this is repeated on a mimic diagram in the control room. The diagram is automatically dressed so far as those parts of the system operating in parallel with the public supply are concerned, and hand dressed for the remainder. The

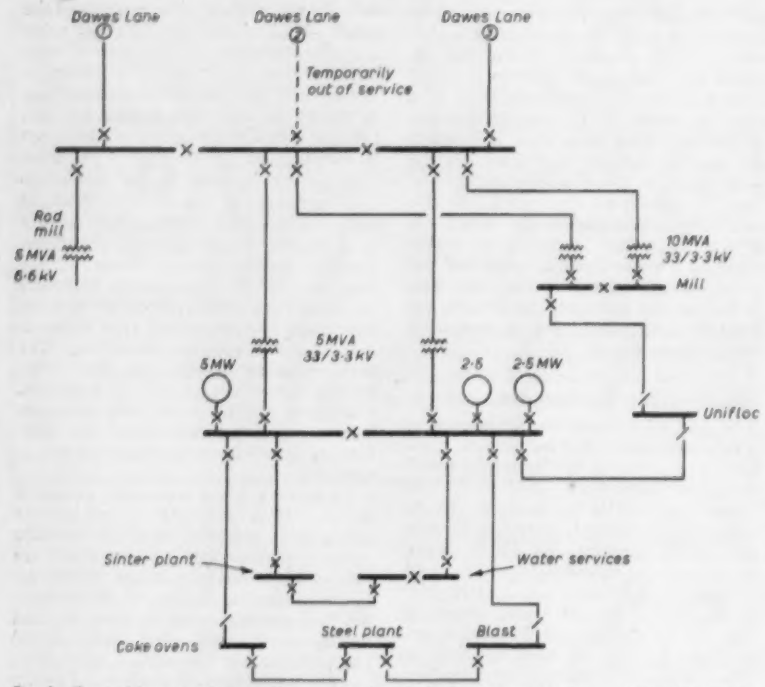


Fig. 2. General layout of h.v. supplies at John Lysaght's Scunthorpe Works. Note that busbar arrangements are only shown diagrammatically

power station board is operated as a double busbar arrangement with not more than 15 MW of plant (generators or incoming transformers) on either section. Operation as a solid switchboard is permitted for short periods during regrouping or under certain fault conditions. All 33 kV and 3·3 kV switching is carried out on orders from the shift control engineer. He is assisted in the control room by a switchboard attendant.

Protective Gear

The incoming 33 kV feeders to the works are protected by the Translay system, with back-up overcurrent and earth leakage at the Y.E.B. end. The 33/3·3 kV transformers are also protected by the Translay system with back-up protection on the 33 kV side. In addition the power station 5 MVA transformers are equipped with an unrestricted single-pole earth fault relay which acts as general back-up to the earth fault protection on the outgoing 3·3 kV feeders and also have directional over current relays fitted on the 3·3 kV side. The purpose of these directional relays, which are set to operate at 100% load, exported from the 3·3 kV system, is to disconnect the power station from the 33 kV system rapidly in the event of a fault occurring at the higher voltage. They also serve to ensure that in the event of complete failure to the grid supply, the Lysaght generation will not be left to attempt to carry the entire Grid load in the Scunthorpe area.

The alternators are fitted with Merz-Price protection and back-up overcurrent and earth leakage of the DMIT type. Outgoing feeders are generally protected by simple DMIT overcurrent and earth leakage elements, but in the case of machines switched directly at 3·3 kV c.t.-operated motor protection relays of the thermal type are employed. The mercury arc rectifiers are protected by instantaneous overcurrent and earth leakage relays on the a.c. side, and on the d.c. side are fitted with cathode over-temperature thermostats, direct acting overload trips and instantaneous reverse current relays.

Special attention has naturally been given to the steps to be taken under fault conditions, and a schedule has been drawn up of action necessary on all foreseeable faults, ranging from loss of supply to a boiler fan to complete loss of Grid power and factory generation. The aim in the more serious faults is, of course, to maintain essential services. The system has been tested in practice to the extent of loss of the Grid supply, and on this occasion worked smoothly. There is an arrangement for sounding an alarm round the works when a general power failure occurs. Shift electricians then attend stated substations and stand by for instructions from the shift control engineer. They are enjoined to attend and then wait, not telephoning the control themselves unless they have definite information to give about the nature of the fault.

Under normal conditions, the h.p. and l.p. turbines operate under inlet pressure governing. The h.p. turbines, of course, exhaust into the l.p. steam main, and the l.p. turbines exhaust to vacuum. About half the works maximum demand is carried by the power station generating plant. The alternators are loaded so that the power station is just exporting, to the 33 kV system, if possible, so that if grid supply is lost, speed will rise rather than fall. The necessary steps which, of course, include changing the turbines to speeder control are then more readily taken. Alternator excitation is arranged so that the works generates as much as possible of its own wattless load. The alternators usually operate at about 0·8 p.f. and the power factor of the load on the public supply is better than 0·9. This is helped by the use of 150 h.p. synchronous motor to drive the exciter for the Ilgner set. This motor is naturally operated at a leading power factor.

All the h.v. switchgear is Castel key interlocked, and there is a permit to work system in operation respecting it. There is also a system of authorised persons in respect of its operation, and this is extended by the introduction of a class of senior authorised persons, who alone may carry out such operations as the earthing and isolation of the 33 kV as distinct from 3·3 kV gear.

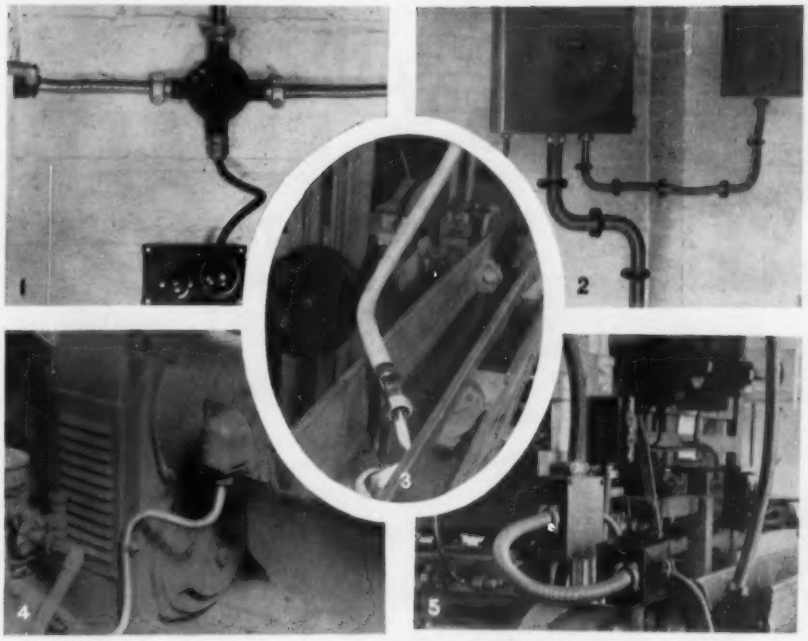
Conclusions

At the heart of the operation of the electrical department at these works is the belief that properly trained men should be given responsibility, in a spirit of confidence in their ability to accept it. The organisation ensures that each man has a clear idea of the extent of his responsibility. Beyond this, opinion and advice from the men on the job is continuously sought by all stages in the management ladder. The reverse of this plan is to ensure that all possible information is made available to all staff. Considerable care is taken to circulate information and to encourage men to study and to extend their experience of steelworks electrical practice by visits to equipment manufacturers works and to the works of other steel firms. The success of the scheme may be measured by the low lost production time figures.

We are indebted to Mr W. James, Managing Director, for permission to visit the works and to prepare this article, and to Mr C. Challinor, Chief Engineer, and Mr M. Rathbone, Chief Electrical Engineer, for assistance in its preparation.

Mill Conversion

Conversion of textile mills to electric drives has been much extended in recent years. Selection of the appropriate motors, and the choice between group and individual drives requires careful consideration and engineers requiring further information on this subject will welcome a small booklet which has been issued recently by the British Thomson-Houston Company, under the title "Cotton Spinning Mills—Conversion from Steam to Electric Drive." It has been prepared by Mr S. Birchall, and is available from the Publicity Department of the company at Rugby, free to engineers writing on business letter head. Particular attention is given in the booklet to the motor characteristics required for the various textile machines to be found in a cotton mill.



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Donovan Type A32
Size 1 Contactor Starter

DATA SHEET 21

THIS is a simple straightforward starter with built-in isolator for industrial application. The case (Fig. 1) of conventional pattern, is a light alloy die casting with a hinged lid on which are mounted the local push button stations. Since the lid is fitted with a rope gasket the case is virtually dust proof. Provision is made for a padlock. The isolator which is fully interlocked with the lid so arranged that when the cover is open, live parts are shielded, is mounted in the top of the case.

The isolator switch consists of fixed clip pattern copper contacts reinforced by steel springs, the fixed contacts being mounted on two porcelain bases. The circuit between them is made by particularly rigid switch blades in a moulded body rotated by the operating lever on the left of the case. The isolator will break the stalled current of the maximum horse power of motor for which the starter is suitable.

From the isolator, current is fed to the contactor. The contactor, together with the overload units, is mounted on a moulded base and forms a self-contained unit. On the lower left side of the case is the reset button for the overload units.

Approximate dimensions:
1 ft 4½ in. x 9½ in. x 5½ in. deep.

Approximate weight: 13·5 lb.

Wall fixing. 1 in. entry on the top and 1 in. and ¾ in. entries on the bottom.

Fuses rated at approximately four times normal load current should be used with this starter to protect against short circuits.

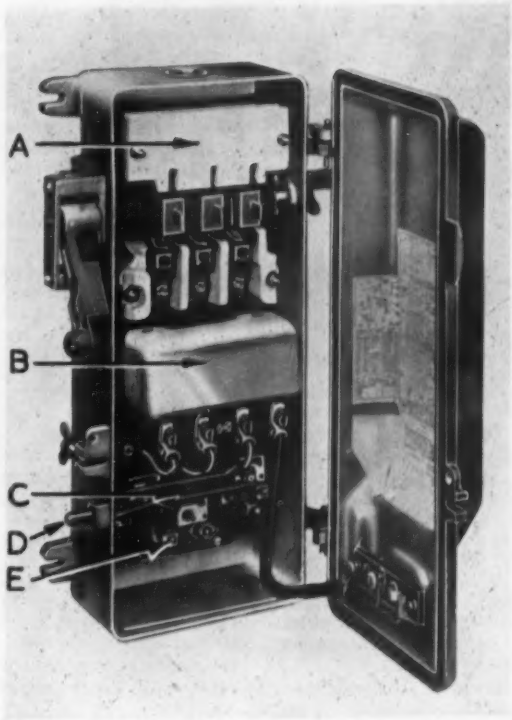


Fig. 1. General view of Donovan contactor starter, showing hinged lid carrying push buttons. A, isolator; B, contactor; C, trip bar; D, reset knob; E, heater and overload units

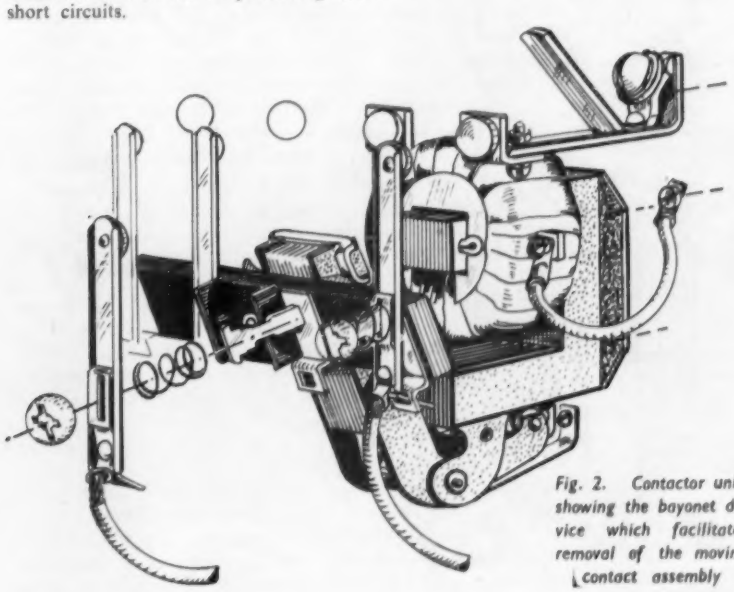


Fig. 2. Contactor unit, showing the bayonet device which facilitates removal of the moving contact assembly

The Contactor

This is of the clapper type, and being a surface mounted mechanism is quite accessible. Its action can be clearly seen, particularly when the arc hood is removed. It is illustrated in Fig. 2. The armature carries an insulated bar to which are fixed the four contact arms, three for the line circuits and one for the control circuit. At the end of the closing stroke a wiping action is imparted to the contacts which are silver alloy rivets, ¼ in. diameter and ample for the h.p. rating of the switch. The general construction follows the normal pattern but the moving contacts, each self-contained with the contact arm and flexible lead are quickly removed by a simple bayonet device as shown in one of the contacts in Fig. 2.

The two horns fixed to the stationary contacts are to support the arc chute.

Thermal Overload Relays

There are three of these mounted immediately below the contactor. They are of the solder film pattern and are shown

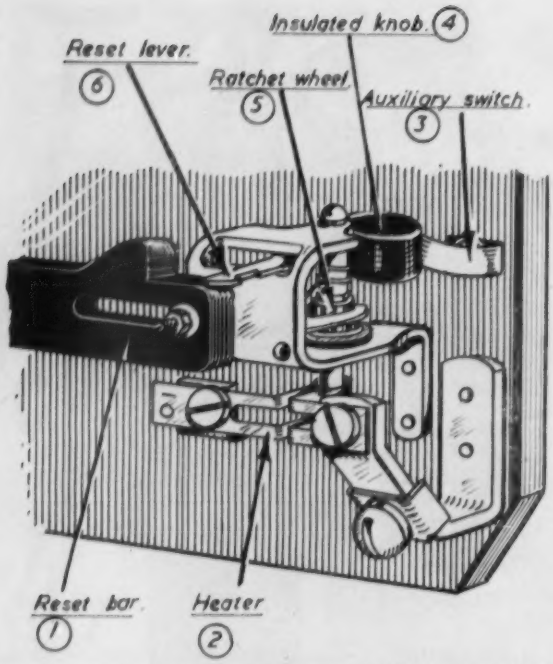


Fig. 3. Details of thermal overload unit, illustrating method of operation. See also Fig. 4

in detail in Figs. 3 and 4. Secured by the solder film is a small brass ratchet wheel (5) which retains the reset lever (6) by the catch (8), in normal circumstances. In this condition the insulated knob (4), fixed on the end of the reset lever, will engage and close the auxiliary circuit switch (3) and permit the contactor coil to be energised.

If, however, an excessive current flows through any one line, the heater (2) surrounding the solder film spindle (9) will cause the film of solder to melt. This will allow the ratchet wheel to rotate and in so doing will release the reset lever (6) which, being under spring tension, will permit the lever to move to the left and cause the knob (4) to lift from the contact and to open the contactor coil circuit.

The solder used is an eutectic alloy which will quickly melt at a predetermined temperature and release the catch (8) Fig. 4.

The release can be reset, assuming no excessive load to persist, by pressing the reset button on the left of the case. After an overload it is desirable to wait one minute approximately to enable the solder to reset, but endeavouring to reset prior to the solder setting will normally cause no inconvenience.

The operation of pushing the bar (1) to the right and in so doing moving the lever (6) to the end of its traverse enables it to be held by the catch (8) on the ratchet wheel after the solder has reset.

These relays are affected by ambient temperature in a similar way to the motor being protected: a rise in temperature results in quicker tripping of the relay under overload conditions. The heaters should be rated 100%-110% of full load current.

Maintenance

Contactor. — All contacts are of silver alloy and do not require dressing. Inspect regularly and replace when the gap between the armature face and magnet core is reduced to 1/32 in. when the contacts just touch. This gap should normally be 1/16 in. to 5/64 in. and contact pressure about 8 oz. The pivot must be kept free: lubricate lightly if necessary. Keep magnet faces free from rust.

The contactor coil is easily removed by drawing the pivot of the armature and pulling out the split pin retaining the coil itself.

Overload Units.—No replacement of parts is needed, and no deterioration follows repeated tripping operation. Heaters are available to suit different amperages from 0·27 amp towards in approximately 10% steps.

If the overload unit fails to trip make sure that the heater is of the correct rating and that the reset push and bar are free to move. Should the relay

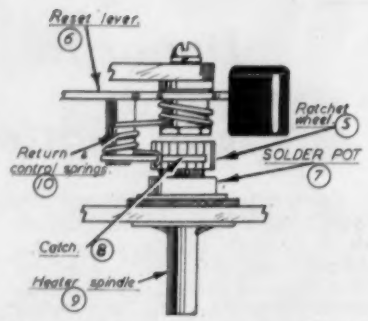


Fig. 4. Details of thermal overload unit.

occasionally fail to reset properly this is sometimes due to it being reset too soon, i.e., before the solder has had time to cool properly. If this occurs it is sometimes possible to melt the solder again and then the relay should be allowed to cool and the reset button again pressed. Generally, the solder may be remelted by heating the heater spindle briefly.

Table 1 gives the typical overload/time relation. The higher values are for the longest time delay normally obtained from the overload relay cold, and the lower values the shortest delay with the unit at full load temperature.

TABLE 1.—TYPICAL TRIPPING TIMES

% ultimate trip current	Tripping Time—Seconds	
	Upper limit	lower limit
100	very long	1,000
200	300	33
300	105	18
400	65	12
500	52	9
600	46	8
700	40	7

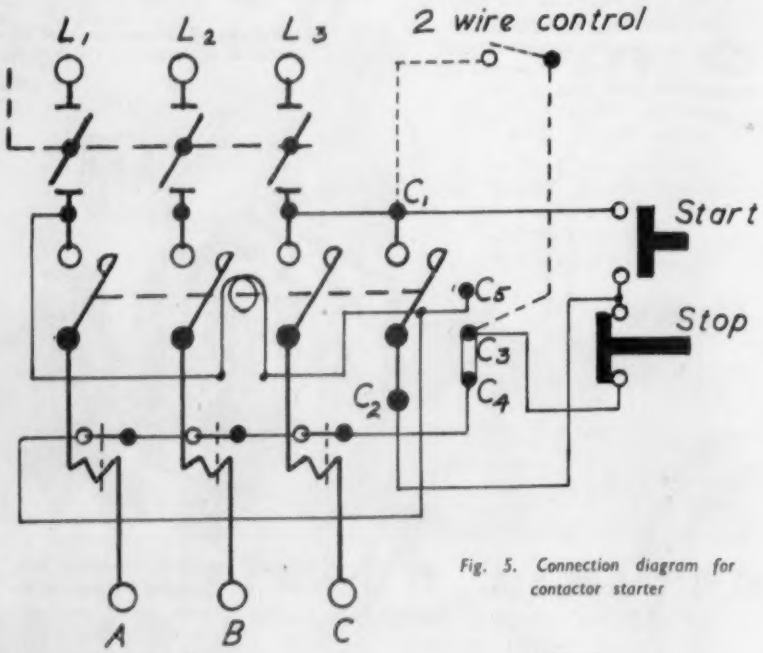


Fig. 5. Connection diagram for contactor starter

Safety in Supply

Chief Inspector of Factories discusses Generation and Distribution

ELECTRICAL topics receive close attention in the Annual Report for 1954 of the Chief Inspector of Factories. This was published last week, continuing the gradual narrowing of the gap between the period with which the report is concerned and the date of availability of the report to industry generally.

The Inspector comments that the number of reported failures in power stations during the year was rather lower than in any previous year. He notes as particularly interesting two internal breakdowns in power transformers feeding into external faults. Both these occurrences were believed to be traceable to heavy and sustained wartime overloading of the transformers.

Fashion in the protection of large alternators swings between extremes of simplicity and complexity, remarks the report: at present it appears to be tending in the latter direction. Passing on to the distribution system, there is the comment that, particularly in rural districts, the reinforcement of systems that has taken place has increased potential short-circuit currents to values at which they are a serious problem. This has rendered many substations obsolete, and has made dangerous some operating practices. For example, reclosing circuit-breakers on to a fault to attempt to clear it has already caused some accidents due to the failure of defective switchgear on heavy short circuits.

This question of inadequacy of short-circuit capacity is widespread. One Electrical Inspector, reporting the position in the North, has stated that in a survey, 41% of the high voltage circuit-breakers were found to be of inadequate breaking capacity, and that to deal with the situation would entail the expenditure of about £1¼m. Since expenditure of this magnitude has to be spread over several years, the danger will not quickly be relieved.

Incidents at several substations during the post-war years has attracted attention to the problem of protecting 132 kV voltage transformers against internal faults. It is understood that the C.E.A. is now making arrangements which will enable the transformers to be protected by Buchholz relays, which will detect a fault in its incipient stages, and the consequent Buchholz alarm will enable the operating staff to take what action they consider necessary.

Industrial Installations

Turning to the industrial applications of electricity, the report mentions the use of special flooring materials for electrical or electronic test rooms. Usually these have good insulating properties, but unless they are laid on some form of waterproof and insulating material, electrical leakage may occur at the joints. The inspector regards it as unfortunate that no standards are at present laid down for materials or methods of construction of such floors.

Cranes are always a serious electrical safety problem. A difficulty that needs special attention is the provision of the statutory clearance around contactor switchboards associated with cranes. Provision of such clearances is simple if it is carried out in the design stage, but is likely to be costly if the requirement has to be met after the crane has been assembled. Since crane control gear has to be tested "live" it is not acceptable merely to install the contactors in a closed cubicle and provide interlocked doors. Experience shows that sooner or later such interlocks will be defeated. Perhaps the simplest way of overcoming the difficulty is to use a voltage for the control circuits below the 125 V minimum to which the requirements mentioned above apply.

Another crane problem is that of avoiding accidents due to unintentional contact with trolley wires. The report again suggests the solution is the enclosure of the wires, and it notes that there are several proprietary forms of enclosure now available. To guard against the risk of a broken trolley wire, a conductor-continuity protective device has been developed which automatically disconnects the supply if the conductor breaks. This involves the use of a star-connected resistor connected at the far end of the line, and an electronic relay which operates to cut off the supply if there is any voltage unbalance due to a wire breaking.

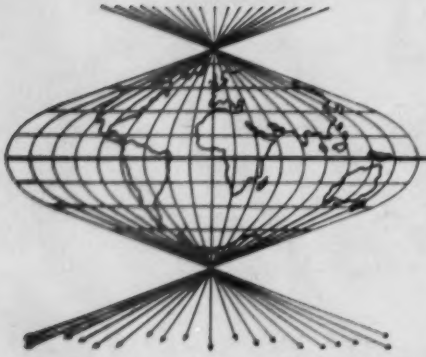
Electrical Accidents

Electrical Accidents in industry during 1954 are analysed by the Inspector as shown in the table. Both fatal accidents and the overall total are lower than for 1953. The magnitude of the risk associated with portable apparatus is again apparent. Consistently they account for about 40 to 50% of fatal accidents and about 35% of all accidents.

Earthing again attracts the attention of the inspector. In factories in rural areas, it may be difficult to obtain a good low-impedance earth connection. It is the opinion of the Factory Department, that few simple spike or pipe electrodes have earth resistances of less than 20 ohms, and 40 to 80 ohms is common.

REPORTABLE ELECTRICAL ACCIDENTS: ANALYSIS BY APPARATUS, 1954

Apparatus	Fatal		Non-Fatal		Total
	Men	Women	Men	Women	
Portable apparatus:					
Portable electric machines	6	—	47	1	54
Portable heaters and irons	—	—	5	2	7
Portable lamps	5	—	15	—	20
Portable test sets including lamps, etc.	—	—	31	1	32
Plugs, sockets and adaptors	—	—	21	3	24
Cables and flex for portables	1	—	27	2	30
Electric hand welding:					
(a) Shock and/or burns	3	—	24	—	27
(b) Eye injuries... ...	—	—	154		154
Fixed apparatus:					
Electrical machinery ...	—	—	8	2	10
Transformers	1	—	3	—	4
Switchgear above 650 volts	7	—	36	—	43
Switchgear below 650 volts	1	—	98	2	101
Fusegear	—	—	35	1	36
Crane trolleys and collectors	1	—	32	—	33
Fixed lamps	2	—	12	—	14
Cables for fixed apparatus	1	—	49	3	53
Test leads	—	—	15	2	17
Overhead transmission and lines:					
Contact by cranes or similar machines ...	4	—	2	—	6
Direct contact or contact through materials handled	1	—	10	—	11
Apparatus not classified ...	—	—	26	5	31
Total	33	—	496	24	707



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Plant Overhaul

Winnipeg City Council's Public Works Committee has approved a $5,600,000 overhaul of the City Hydro's Point du Bois power plant. The overhaul was one of three alternatives recommended by engineering experts who surveyed the plant last year. The Committee approved a start on the overhaul job following a warning by Mr Storey, manager of the Hydro, that it was essential to get on with it because the plant in its present condition was not considered very safe. He said serious trouble which might have resulted from a fire at the plant recently was only averted by quick-thinking employees. Both l.t. gear (between the generators and transformers) and h.t. gear were inadequate, he said.

Rural Electrification

About 87% of farms in Quebec are now supplied with electricity and the programme of rural electrification is to continue, it being proposed to allocate a further $25 millions to the Rural Electrification Fund for the purpose. This information was given to Quebec's legislators a few days ago.

U.S.A.

Nuclear Power

America will not be producing nuclear industrial power on a broad economic scale until about 1965—some five years later than Britain—according to officials of the U.S. Atomic Energy Commission. They have stressed that what might be considered economical in Britain would not necessarily be judged economical in the U.S. because of the relative costs of conventional power. An official of the Westinghouse Corporation, Mr Weinzimmer, has stated that his company are well up to schedule in construction of their part in America's first full-scale nuclear power plant, which it is hoped to have in operation by the first half of 1957.

Gas-Turbine Locos

Fifteen 8,500 h.p. gas-turbine electric locomotives are to be supplied to the Union Pacific Railroad by the American General Electric. These are believed to be the most powerful rail units ever designed. The G.E. have been given to understand that a further 30 similar locos may be ordered at a later date.

BARBADOS

Tariff Changes

Changes in electricity tariffs which will most benefit the small domestic consumer, have just been put into operation by the Barbados Light and Power Co., Ltd., (which recently took over the Barbados Electric Supply Corporation). Firstly, meter rents for general lighting have been abolished. Then the 10% discount for prompt payment under tariff No. 1—general lighting—applies to the whole bill instead of as formerly, only on bills of over 80 c., or on the unit charge. This alteration also applies to the domestic all-purposes tariff. Incidentally, Mr R. B. Francis, manager of the company, is anxious that there should be no delay in the construction of the 20 MW steam power station. Over 20 million units were generated by the undertaking last year, and he reports that the load is growing rapidly, although at the moment there is sufficient standby plant.

NORWAY

Power Export

The Norwegian Parliament has now approved, by 81 votes to 63, the Government's proposals for exporting hydro-electric power to Sweden from a plant to be built at Nea, near Trondheim. Annual output of the plant is estimated at 600m units, of which the Stockholm city authorities have agreed to purchase 330m to be exported annually to the Swedish capital at a price ranging from a maximum of 2·9 Swedish ore (equivalent to nearly ¼d.) in winter, to half that amount in summer. Total cost of the Nea power station is estimated at £5,900,000, of which £4¼m will be raised by a loan in Sweden. The Swedish Government approved the scheme in March, 1954.

EUROPE

Protection Sought

Seeking further protection for the local electrical manufacturing industry against foreign competition, the Portuguese Industrial Association has alleged that certain types of electrical equipment are being sold in Portugal at dumping prices. The Association alleges that exceptionally severe competition has forced prices well below normal production cost, and this has had severe repercussions on the local electrical industry. Goods particularly in mind are electric motors, transformers and conductors. The Association claims that local production of transformers has increased by 50% in the past six years, during which time the cost of imported transformers has halved. For this reason further protection is sought. It is stated that in the first 9 months of this year, Portugal imported 143,667 transformers of up to 2½ metric tons, to a total value of 14 million escudos; of which Dutch firms supplied 74,756 (2m escudos), West German concerns 34,903 (3·6m escudos) and British 13,348 (2m escudos). Most of the electric motors imported were from Western Germany.

H.E. Project

Work on a new hydro-electric project at Geesthacht, in Schleswig-Holstein, was formally inaugurated last week by Dr Seebohm, the West German Minister of Transport. The scheme, to be constructed on the River Elbe, will be the largest of its type in North Germany, and will consist of a dam and two power stations. There is to be a 3-mile-long canal to enable shipping to by-pass the dam. The work is expected to take five years to complete, and will cost 155 million marks.

RUSSIA

Electrification Plan

A 15-year railway electrification scheme is to be launched in Russia next year, it is announced. In the first five-year period some 3,000 miles of the Moscow-Vladivostok railway system are to be converted to electric operation, according to the plan. It is evident that the work will progress to tie in with the completion of the large hydro-electric schemes now under construction.

MIDDLE EAST

Gas Turbines for Palestine

In addition to the two steam power stations which are now under construction, the Palestine Electric Corporation is planning the establishment of several smaller plants of about 10,000 kW each, we understand. The new large steam stations are being built near Tel Aviv (to have two 20 MW sets) and at Sukreir (to have two 50 MW machines). The smaller plants will be erected in various rural districts, and are to be equipped with gas turbines. Orders have already been placed with Brown, Boveri, of Switzerland for two such sets. The Cor-

poration is also shortly to make a start on the construction of a h.t. transmission line to Upper Galilee, where at present the settlements have to rely on small diesel-driven generating sets. The line is planned to run from the Jordan Valley transformer station up to Kiryat Shmoreh.

High Finance

The U.S. Congress is to be urged to approve a 10-year plan to provide Egypt with $200 millions in foreign aid to help construct the High Aswan dam, it is reported. This would be in addition to the loan being negotiated with the World Bank. Part of the U.S. loan might be in the form of blocked sterling, it is stated.

AFRICA

Diesel-Electrics ?

The South African Railways have decided to purchase some diesel-electric locomotives, and capital for the purpose is to be set aside in the railway estimates for next year, it is announced. Preliminary investigations have already been carried out into the use of diesel locos, the first of which will probably be used for shunting purposes at the larger centres.

INDIA

D.V.C. Order

The Damodar Valley Corporation, of India, has placed an order with the Swedish firm, Nydquist and Holm, for a Kaplan water turbine for the Panchet Hill power station. The machine will have an output of 56,750 h.p. at 125 r.p.m. operating on a head of 24·7 metres, and a maximum output of 81,000 h.p. on a head of 34·47 metres. The contract provides for delivery of the machine within two years.

AUSTRALIA

Boiler Delay

A further 30 MW turbo-alternator is expected to be commissioned at the Tennyson power station of Brisbane City Council, but as its associated two boilers are not expected to be ready for at least 5 months it will not mean any additional generating capacity available. Alderman Kruger, chairman of the Transport and Electricity Committee, has said that the boiler delay was due to the 21-week strike of metal trades workers employed by the boiler contractors, which ended in July. Originally the boilers were expected to be in operation by the end of this year, but now the first will probably not be ready till next May.

N.S.W. Railways

Marking the completion of the second stage of the Sydney to Lithgow, New South Wales, main line electrification, the electrified line to Penrith was inaugurated recently by the Hon J. J. Cahill, premier of N.S.W. With the completion of that stage there is now an electrified suburban service between Penrith, at the foot of the Blue Mountains, and Sydney. During trial runs with an electric locomotive on this latest section the overhead equipment was satisfactorily tested at a speed of 70 m.p.h., the 20 miles distance between Parramatta and Penrith being completed in 21 minutes in each direction. At the opening ceremony British Insulated Callender's Cables (Australia) Pty. Ltd., the contractors responsible for the design, supply and erection of the 1,500 V d.c. overhead equipment being used on this route, were represented by the chairman of the company, Sir T. Malcolm Ritchie.

NEW ZEALAND

Survey Wanted

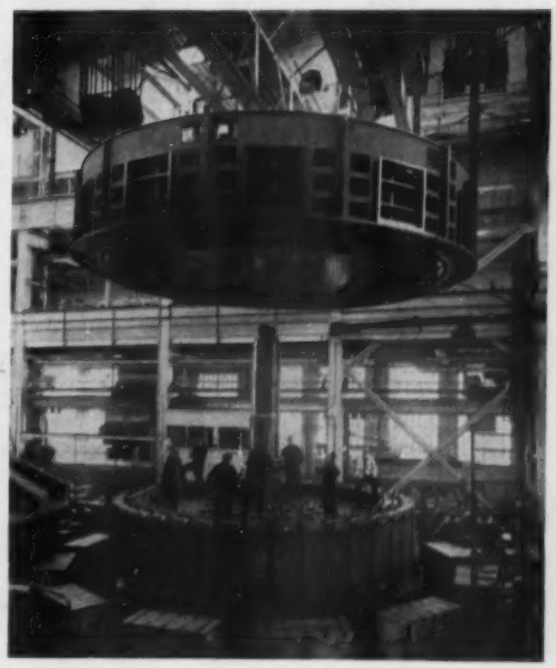
A comprehensive preliminary survey of all remaining potential hydro-electric resources, even relatively small schemes, of New Zealand has been urged by the president of the New Zealand Electric Supply Authority Engineers' Institute, Mr N. A. Davidson. The investigation would determine which schemes were capable of economic development, compared with fuel stations, he said. While hydro resources remaining under-developed might be relatively small in relation to the total future requirements of the North Island, they could make a continuing useful contribution to the conservation of coal. Power system interconnection would cause a new evaluation of many schemes abandoned in the past after an initial survey, he continued. With new techniques of transport and construction and the transmission of energy, inaccessible water power sites now presented few difficulties. The energy contribution of a slow-flowing river might well be found to be entirely justifiable if adequate transmission capacity was available. There was a possibility, too, that small hydro schemes isolated from the grid might be complementary to the work of the special Rural Electrification Committee investigating the supply to remote communities.

Good Results

The Waitemata Electric Power Board made an operating profit of £16,786 for the six months ended 30 Sept. last, compared with £22,709 for the corresponding period last year. Mr P. G. Smith, the secretary-treasurer, considers that on this basis there should be a healthy operating profit at the end of the year. The half-year's profit was insufficient to finance purchases, which totalled £24,933, however.

Heavy Water Cost

The U.K. Atomic Energy Authority is reconsidering its commitment to finance the Wairakei heavy water project in North Island, N.Z., because of an estimated 100% increase in the cost, it is reported. Mr Holland, the N.Z. Prime Minister, has stated that the matter is to be considered at a Cabinet meeting. Under the agreement, a year ago, a joint company, Geothermal Development Ltd., was set up with the A.E.A. providing one-third of the capital. It was part of an arrangement to build a plant at Wairakei to produce heavy water (which the A.E.A. would purchase) and electricity (for the State Hydro Electric Dept.) from geothermal steam. Orders for some of the plant have already been placed.



In the accompanying photograph is shown the stator of a large waterwheel alternator about to be lowered into position round the rotor during assembly for running tests at the Rugby works of the British Thomson-Houston Co. This machine is one of two 66,670 kVA, 150 r.p.m. alternators being supplied to the State Electricity Commission of Victoria, Australia, for Eildon power station. The stator is 33 ft 3 in. in diameter and weighs 141 tons. Two cranes were required to lower it into position and very careful manoeuvring was necessary as the minimum air gap is only 0·81 in. The alternators will be driven by Francis turbines supplied by Boving and Co., the main contractors

Personalities

IN THE INDUSTRY

Sir Rex Hodges, J.P., has been appointed to the board of the Automatic Telephone and Electric Co., Ltd., to fill the vacancy caused by the resignation of **Air Vice-Marshal O. G. Lywood,** C.B., C.B.E. Sir Rex Hodges joined the board of British Insulated Callender's Cables Ltd. in April, 1954, following his retirement from the position of general manager and secretary of the Mersey Docks and Harbour Board.

Mr Victor Watlington, M.B.E., A.C.G.I., M.I.E.E., and **Mr T. W. Heather,** M.C., have been re-elected for the eleventh year in succession to act in their respective capacities as chairman and vice-chairman of the Electrical Fair Trading Council.

Mr D. A. Hannay has been appointed a director of the Cooper-Stewart Engineering Co., Ltd. He joined the company last March as general manager.

The Minister of Fuel and Power has appointed **Mr T. Coates,** M.ENG., M.I.E.E., M.I.MECH.E., as deputy chairman of the North Western Electricity Board as from 1 Jan. next. He will succeed **Mr T. E. Daniel,** M.ENG., M.I.E.E., A.M.I.MECH.E., who has been appointed chairman of the North Western Board in succession to Sir Joseph Hallsworth, as we have already noted. Mr Coates, who has been sub-area liaison officer and manager of the Chester sub-area of the Merseyside and North Wales Electricity Board since 1948, was earlier, deputy city electrical engineer at Liverpool for three years. Educated at Oundle and Liverpool University, he went to Metropolitan-Vickers Electrical Co. as a college apprentice. He joined the Liverpool Corporation Electricity Department as a technical engineer and two years later became chief technical assistant. At the outbreak of war, Mr Coates joined the Royal Navy (Air Branch) as a pilot, and commanded an Air Squadron for two years before being recalled to Liverpool in 1943 to resume his former work there. Mr Coates was chairman of the I.E.E., Mersey and North Wales Centre, in 1953/54.

Mr Norman Campbell, M.B.E., B.SC., A.M.I.E.E., was injured in an explosion at the Dores substation, Inverness, of the North of Scotland Hydro-Electric Board a few days ago. Mr Campbell was taken to hospital with burns to his face, hands and legs. He had apparently gone to the substation to investigate a fault which had occurred during a severe storm. The Inverness area was without a supply for several hours. At last week's meeting of the Inverness Town Council, Provost Robert Wotherspoon, congratulated Mr Campbell on the prompt action which he took after the breakdown occurred. Apparently Mr Campbell found the switch room door was open and as he closed it there was a violent explosion, as a result of which Mr Campbell suffered injuries.

Commander M. A. Chapman has ceased to be a director of Associated Insulation Products Ltd.

Dr G. F. J. Garlick, PH.D., B.SC., has been appointed to the Chair of Physics at the University of Hull, in succession to **Professor L. S. Palmer,** who retired some time ago. Dr Garlick has been in charge of the luminescence laboratory in the Department of Physics at Birmingham University since 1943, and has served as lecturer in physics in the university since 1949. Dr Garlick takes up his new duties on 1 April next.

Appointed as assistant sales manager of George Ellison Ltd. is **Mr P. C. Pritchard,** pictured below. He will assist **Mr G. A. P. Jewiss** in the general supervision of all sales activities for switchgear and will be in direct control of the internal sales organisation. Mr Pritchard was educated at Warwick School and served an apprenticeship with the B.T.H. Co., Ltd., Rugby, before joining the sales engineering staff of George Ellison Ltd. in 1946. After serving for a period as technical representative for switchgear in the Birmingham area, he joined in 1950 A. G. Bruty Ltd., the Eire agents for George Ellison Ltd. He was later elected to the board of directors of A. G. Bruty Ltd., and the associate company, the Bruty Engineering Co., Ltd.

A director of Mervyn Instruments Ltd., and honorary exhibition secretary of the Physical Society, **Mr A. G. Peacock,** B.SC., A.R.I.C., A.INST.P., has been elected chairman of the Electrical and Electronics Section of the Scientific Instrument Manufacturers' Association, in succession to **Mr P. Goudmine,** M.A., managing director of Electronic Instruments Ltd. The vice-chairmen of the Section are **Mr R. Y. Parry,** of Ekco Electronics Ltd., and **Mr L. A. Woodhead,** of Cossor Instruments Ltd. The Section, by the way, is now actively engaged in the organisation of an exhibition entitled "Atoms, Electrons and Industry," to be held in Bristol on 6-8 June next.

Mr S. G. Copping has been appointed London area sales representative by Electropower Gears Ltd. Mr Copping was previously London sales representative for the Anchor Chain Co.

His many friends in the industry will be sorry to hear that **Mr J. Dunford Smith,** F.I.A.M.A., has had to retire from the position of advertising manager of W. T. Henley's Telegraph Works Co., Ltd., on account of ill-health. He is succeeded by **Mr A. S. Brewer,** M.I.A.M.A., who joined Henley's in 1922, transferring to the Advertising Department to serve under the late Mr W. A. Moore in 1925. Since that time he has worked on every aspect of the company's advertising, being appointed assistant advertising manager in 1954. Mr Dunford Smith joined the Henley Research Laboratories early in 1920, and transferred to the advertising

Sir Rex Hodges

Mr T. Coates

Mr P. C. Pritchard

Mr S. G. Copping

Mr A. S. Brewer

side of the company in 1929, being appointed advertising manager in 1946. He was editor of the company's house journal, *Distribution of Electricity*, and was also advertising manager of Henley's Tyre and Rubber Co., Ltd., and other subsidiaries in the Henley organisation.

J. A. Prestwich Industries Ltd. announce that **Mr W. R. Bishop** has accepted an invitation to join the board of the company. Mr Bishop is well known in a variety of industries connected with engineering and from 1953 has held the appointment of sales manager to J. A. P., which he was invited to join after three years as group sales manager of Sheepbridge Engineering Ltd. During that appointment (1950-1953) the Sheepbridge group expanded to 14 companies dealing with light and heavy engineering. His post-war career includes the appointments of sales manager to Wellworthy Piston Rings, and the same executive rank with J. Stone and Co. (Charlton) Ltd.

Mr W. F. Griffiths, B.SC., A.M.I.E.E., F.I.E.S., has been seconded by Crompton Parkinson Ltd. to take over from **Mr C. J. Close** as general manager of Crompton Parkinson (South Africa) Pty. Ltd., Johannesburg. Mr Griffiths joined Crompton Parkinson Ltd. as a sales engineer in May 1950, after five years with Siemens Electric Lamps and Supplies Ltd. During the war he served with the Royal Corps of Signals, attaining the rank of Major. Mr Griffiths flew to Johannesburg on 6 Dec., to assume his new duties. He will be joined there early next year by his wife and three-year-old daughter. Mr C. J. Close, who has been with Crompton Parkinson's South African company for nearly 25 years, leaves at the end of Dec. to take up an appointment at Kitwe, Rhodesia.

Our photograph below shows **Mr Frank Christy,** M.I.E.E., with the birthday cake at the celebrations to mark his 90th birthday, to which we referred last week. Founder of the business of Christy Bros., electrical engineers and contractors, 72 years ago, Mr Christy was presented with an illuminated address in album form by **Mr A. A. Gates,** chairman, at a party given in honour of the occasion.

Mr Frank Christy cuts his cake

For the first time in the fifty years' history of N.A.L.G.O., life-membership of its National Benevolent and Orphan Fund has been bestowed on a Bradford man—**Mr Robinson Hodgson,** an employee of the Yorkshire Electricity Board. He was presented with his certificate at the annual meeting of the No. 1 sub-area Y.E.B. branch of N.A.L.G.O., of which he is a former president, the honour being conferred in recognition of his valuable services to the branch and the national body.

Mr W. F. Griffiths

Mr W. R. Bishop

Mr G. W. Alexander, Mr W. Messer and **Mr G. W. Davidson** have been appointed directors of the Rhymney Engineering Co., Ltd., which is owned jointly by Powell Duffryn and International Combustion (Holdings) Ltd.

Mr Sam Black, F.I.P.R., has been appointed head of the Publicity Department of the British Electrical and Allied Manufacturers' Association in place of the late Mr J. J. Conlan. Mr Black, who was previously director of the Information Bureau of the Association of Optical Practitioners, is a well-known figure in the publicity world. He was chairman of the Institute of Public Relations in 1954-55 and editor of the *Westminster Review and Vision*. He is also a member of the Illuminating Engineering Society. Mr Black has had considerable experience of lecturing and broadcasting for the B.B.C. on their overseas programmes on such subjects as lighting, of which he is an acknowledged authority. He has also been a frequent contributor to various magazines.

The J. and P. Staff Association quite recently held a well attended dinner, dance and cabaret, at the Connaught Rooms, when **Mr G. Leslie Wates,** J.P., COMP.I.E.E., chairman and joint managing director of the company, proposed the toast of the Staff Association. He preceded his remarks by a heartfelt tribute to Mr W. F. Smith, former chairman of the Association, who died recently. Responding, **Mr C. E. Collar,** A.M.I.E.E., said that during next year Mr Wates would be celebrating his jubilee as chairman of the company. He concluded by emphasising the very happy human relations existing between staff and management, the great future for all employed in the Electrical Industry, and the big part played by J. and P. in the export market.

OBITUARY

Mr A. A. Kift, who served with Marconi's Wireless Telegraph Co., Ltd., for 43 years, retiring in 1945, died on 4 Dec., aged 74. He was trained as an electrical engineer at Finsbury Technical College, and joined Marconi's in 1902. After a course at the training college, he was appointed to the engineering staff of the company. During his long career, Mr Kift's work for the company, afloat and ashore, ranged from Labrador to the Black Sea Coast, with erection of wireless stations in Britain interspersed with his foreign travel. In 1912, his practical experience was brought to bear upon matters of administration, and during the next twenty years he became successively sales manager, assistant engineer-in-chief and contracts manager. He relinquished the latter office upon reaching normal retiring age in 1941, but continued in the company's service until the end of the war, retiring in 1945.

Mr L. Morgan, lighting superintendent to Kirkcaldy Corporation, died on 6 Dec.

Councillor S. C. Bradley, proprietor of the Sheffield electrical contracting business of W. Bradley and Son, which was founded by his father, died on 5 Dec., aged 54. He was first elected to Sheffield City Council in 1949, but lost his seat and was off the Council between 1952-53.

Mr F. C. Burstall, deputy managing director of the Automatic Telephone & Electric Co., Ltd., died on 7 Dec., aged 66. Mr Burstall took up executive appointments with A.T. & E. in 1931, after a period as deputy director-general to the Egyptian State Railways, Posts and Telephones. He became director and joint general manager of the company in 1951, and general manager three years later. Educated at Magdalen College School, Oxford, he began his career in telecommunications with the National Telephone Co. in 1904, and later served with the traffic branch of the G.P.O. in Liverpool.

Mr E. Scriven, ASSOC.I.E.E., senior assistant transmission engineer (construction) to the South Wales Division, C.E.A., died on 25 Nov. Prior to nationalisation he was with the Central Electricity Board for 16 years, following service with A. Reyrolle and Co., Ltd.

Mr A. Mycoe, traffic manager to the Metropolitan-Vickers Electrical Co., Ltd., for 35 years, died on 4 Dec., aged 67. He played an important part in the design and construction of special railway and road vehicles for the conveyance of heavy stators and transformers. He had been chairman of the B.E.A.M.A. Traffic Committee, president of the Manchester and District Traffic Association (for 6 years) and president of the Traffic Managers' Club.

NEW LITERATURE

Electro-Technology

by M. G. Say, PH.D., M.SC., M.I.E.E.

FIRST published in 1947, this well known work in its second edition presents in concentrated form the electrotechnical basis of the phenomena which are important in light and heavy electrical engineering. Suitable as a reference for practising electrical engineers or a textbook for more advanced students, the book does not deal with special technologies such as machinery, switchgear or electronics, but with the common features of applied electrical theory on which such technologies are based.

An introductory section deals with fundamental principles and includes a comprehensive list of definitions. The second part of the book provides a guide to the handling of circuit problems. Two and four terminal cases are considered, balanced and unbalanced three-phase circuits also are included. Those who have to calculate electrical quantities in all types of circuits and networks will find the collection of network theorems extremely useful. Worked examples have been included at practically every stage and the reader may revise his memory regarding standard mathematical forms which have been listed for such a purpose in the final section devoted to mathematical tables. Additional tables containing applicable mechanical and electrical constants further enhance the value of this volume as a source of reference. Second edition. Published by Newnes, 167 pages, 8¼ in. by 5¼ in. Price 10s. 6d.

Storage Batteries

by G. W. Vinal

THE fourteen years since the previous edition of this book was published have seen a considerable technological advance in battery design and construction which are admirably recorded in the present edition. In fact, the book has been largely rewritten and it will be appreciated that inclusion of new material without a marked change in size has meant deletion not only of obsolete material but drastic cutting of less important matter. On the other hand, the historical section has been augmented, whilst a number of new illustrations also appear. Despite its high price and American flavour, it remains an excellent survey of modern batteries, primarily of value to users and engineers intending to specialise in this subject.

From an introductory history of the industry in America, the book gets to grips with the subject in an extensive account of materials used in batteries, and manufacturing technique employed. The electrolyte itself receives a whole chapter, much of it concerned with sulphuric acid. Successive chapters then discuss battery theory, capacities and operation, the latter dealing extensively with charging and discharging procedures. Battery internal resistance and efficiencies are also dealt with, whilst considerable attention is given to testing. To conclude the book comes a useful survey of present day battery uses. Fourth edition, published by Chapman and Hall, 446 pages, 9 in. by 6 in. Price 80s.

Sell's Building Trades List

CLASSIFIED under some 2,700 descriptive trade headings in this annual are details of the leading firms in Gt. Britain and Ireland engaged in the building and associated trades. Supplies of all types of electrical equipment are well represented, from which we would judge that the volume has been carefully prepared to provide an extremely useful buyers' guide to all seeking sources of supplies of materials and requisites used in building construction work. The lengthy list of builders and contractors are divided into counties for easy reference, the addresses and telephone numbers of the firms being given in each case. Published by Business Dictionaries Ltd., 500 pages, 10 in. x 8 in., price 25s.

Elements of Servo Mechanism Theory

by G. J. Thaler

MODERN emphasis on automatic control has, among other things, resulted in the word "servomechanism" coming to be associated with a variety of meanings, which, although considerably departed from its original definition, do, fortunately, refer to automatic control systems. In this book, however, the word is more rigidly (and correctly of course) interpreted as being a feedback control system having a mechanical position as its controlled variable. Although the text naturally emphasises the closed-loop automatic position control, the book is particularly valuable in that it includes considerable material aimed at developing a broader concept of automatic control of which servomechanisms are but a part. The book is American in origin, although the subject transcends national boundaries, and being a text-book, is designed to fit into the American education system, being intended for senior undergraduates. Senior students of engineering degree courses should find little difficulty in following the work, particularly as the basic theory is presented without using operational calculus or complex variable theory. This restriction of the mathematical level, however, precludes rigorous discussion of the Nyquist criterion.

Emphasis is given to frequency response methods, in view of their common use in practical engineering, whilst polar and logarithmic approaches to analysis and design are integrated and compared. The subject is introduced logically, general aspects of analysis and design giving way to a discussion of transient analysis, transfer functions, and their plotting, the latter being the point at which the polar and logarithmic methods are introduced. In following chapters, each topic is then discussed in terms of both the polar plot and logarithmic plot as far as this is possible. Analysis of single loop system is considered, followed by a discussion of methods by which performance specifications may be met, and chapters devoted to adjustment of gain and compensation methods. The book closes with an introduction to advanced topics of linear theory and the nonlinear system, and appendices on servo components and Laplace transformation. Each chapter, moreover, is complete with suitable problems, which, the reader is warned, require computation time of up to 30 hrs. Published by McGraw-Hill, 282 pages, 9 in. by 6 in. Price 53s. 6d.

Year Book of the Heating and Ventilating Industry

MORE than just a directory, this ninth edition provides technical, contractual and other trade information which should be of considerable assistance to architects, consulting engineers, and all others who deal with heating and ventilating work. The volume opens with several technical articles on fuel consumption, heating and ventilating on the farm, selection and application of unit heaters, and a review of the use of panel heaters. There follows a collation of references in other technical publications, model by-laws, national working rules and wages agreements, and a list of members of the Association of Heating, Ventilating and Domestic Engineering Employers, who have collaborated in the publication of the volume. A comprehensive buyer's guide, manufacturers' addresses and trade names, occupying over 150 pages, provides a wealth of useful information. Published by Technitrade Journals Ltd., 380 pages, 5¼ in. by 8¼ in. Price 7s. 6d.

BOOKS RECEIVED

Mechanical World Electrical Year Book 1956. The latest edition of this popular handbook contains an additional section devoted to electronic fundamentals and methods, whilst new matter is also given elsewhere. 49th Edition, published by Emmott and Co., Ltd., 31 King St West, Manchester 3, 359 pages, 6 in. by 4 in. Price 3s. 6d.

Mechanical World Year Book 1956. Special emphasis is given to gas turbines in a new section on design procedure, whilst additional or revised material appears elsewhere. 69th edition, published by Emmott and Co., Ltd., 31 King St West, Manchester 3. 254 pages, 6 in. by 4 in. Price 4s. 6d.

Law and the Engineer by C. F. Mayson. Particularly for electrical and mechanical engineers, and advanced students, discusses civil law as it affects the engineer. Published by Chapman and Hall, 470 pages, 8¼ in. by 5¼ in. Price 63s.

PROBLEMS AND PRACTICE

In Engineering

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Earth Terminals

WHILE agreeing whole-heartedly with J. Mellanby (17 Nov. issue) on the need for internal earth connections on control gear, I would like to point out that he can get over the difficulty quite easily by the following methods. On metal clad control gear it is quite a simple matter to drill a 3/16 in. hole in the casing and use a 2 B.A. nut and bolt with two washers on the inside of the case to provide an effective earthing terminal. The earth wires may be twisted together and a loop formed round the screw, or, better still, sweated into a soldering lug and the lug bolted to the inside of the case.

With insulated gear it is preferable to twist together and solder the earth wires, which makes a more satisfactory job than using a connector and takes up less space. I personally find that self pressurising methylated spirit lamps, which are almost instantaneous in starting, are indispensable for these small soldering jobs.—*W. Satchwill.*

(We wish to point out that G.E.C. are manufacturing insulated control gear with an earthing terminal provided.)

Electrical First Aid

WHEN called to attend to an electric cooker which had been put into service after being in store for some time, the customer informed me that when the boiling-plate was switched on the fuse blew. This had happened several times and a heavier fuse had been inserted each time, but without success.

The boiling plate was the solid type with the element embedded in cement. As I had the "Megger" insulation tester handy, I tested the plate and found not unexpectedly, that the insulation resistance to earth was low enough to account for the fuse "blowing" each time. The beaded connections were found to be in order so I concluded that the low heat was due to moisture which had crept into the cement and lowering its insulation. As the customer was convinced that the plate was finished, I decided that I should render "first aid" on the spot, and, if this failed, nothing would be lost at all events.

I fixed the plate back in position, removed the earth wire from the cooker and switched it on in "low" position. After about five minutes I altered the switch to the "medium" position and after about another five minutes to "high," where it was left for about ten minutes. During the experiment, I noted any changes in the cemented element, whilst making sure that no personal contact was made by myself or other persons as the cooker itself was live when first switched on.

After switching off and allowing the plate to cool, I tested its insulation again, this time obtaining quite a good value, as expected. On refixing plate, replacing earth wire, and switching on the plate, no trouble at all was experienced, and, in fact, the plate has given faithful service since.—*J. H. Robinson.*

Vibration Troubles

A FAULT occurred recently which typifies a problem that has been the subject of considerable research during the last year or two. In order to provide a source of artificial three-phase, a factory had installed a pilot motor. Subsequently an additional pilot, slightly smaller, was added as a standby in case of trouble. Curiously enough, the smaller unit proved to give the better results and so the original motor became the standby plant and was not used for quite some considerable time.

Due to an alteration in the factory plant the standby pilot was called into operation, and although the motor was in new condition the bearings were found to be very bad. As soon as the emergency had passed the motor was dismantled by the maintenance man and new bearings fitted.

The standby motor now became idle again and beyond an occasional run up was not used for about a year. Once again the bearings were thought to be bad and at this juncture the writer was called in to help locate the trouble. The maintenance man expressed the opinion that the trouble could hardly be in the bearings themselves since they were fitted so recently and not used, moreover he had experienced a similar trouble on another motor in the factory which had been found due to a loose fan on the rotor and not to the bearings as he had first thought.

The two motors in question were mounted on r.i.j's on the roof girders, tandem-wise and close together. The faulty motor was checked by a time honoured device using a screwdriver as a stethoscope and the drive end bearing found to be very rough.

The motor was removed for overhaul, stripped down, the bearings removed and washed. The fault was now very apparent, the outer race of the roller bearing had deep narrow lines etched in its surface, the distance between them being equal to the distance between the rollers with the deepest groove on the bottom dead centre.

The cause also was quite obvious. The rotor of the standby motor had been stationary for long periods and the vibration due to the other pilot, running continuously every day, was imparted to the idle machine with the resulting damage to the bearing.

There are two especial points of interest, firstly that the deepest groove, at the bottom of the race, appeared to be more "etched" than worn and was red with rust, in spite of an adequate supply of lubrication in the bearing cavity. The insulation of the machine being good, precluded the possibility of leakage currents in the bearing. Evidently the grease used, being of a fairly high melting point, did not flow and lubricate the bottom roller under the normal ambient temperature. This was rather surprising since normally grease always tends to settle at the bottom of the bearing when a motor is shut down.

Secondly, prevention of such damage was a problem. It is quite possible that if the motor was moved to another position, on the floor of the shop for example, the vibrations from the main motor would no longer be imparted to the standby machine, but, it would still receive vibrations from heavy lathes quite nearby.

The simplest suggestion was to inch the standby motor every morning when the main motor was started and if possible, to use it for the main supply for a short period each week.—*K. W.*

Looping of Switch-fuses

AS an Installation Inspector, I have often come across such incidents as the looping of switch-fuses, described in the 17 Nov. issue and this can be regarded as bad practice. However what does attract my attention in "Surveyor's" observations is the fact that a 15 A, s.p.n. switch-fuse is looped from the mains side of a 150 A, t.p.n. switch-fuse. I take it that the 15 A switch-fuse is fed with 7/·029 v.r.i. in conduit, being a quarry installation. What happens if the 15 A switch-fuse itself goes down to earth—what fuse is to be behind it? Moreover, should this 7/·029 cable be in a conduit with other cables the result could be serious.—*N. Stopford.*

In connection with the above, it will have been realised in the original contribution that the circuit showing the lighting supply in the lift machine room should have indicated that the line conductor to the 15 A s.p.n. switch-fuse was connected to the incoming terminal of the 30 A t.p.n. switch-fuse and not to the fuse terminal as shown.

Equipment for Industry

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Improved Sequence Timer

A CONCERN specialising in the manufacture of electrical control apparatus, has recently introduced a new heavy duty cam operated sequence timer. This latest equipment produced by the ELECTRICAL REMOTE CONTROL CO., LTD., South Rd, Harlow New Town, Essex, has a switching capacity of 15 amps at 240 V a.c., some three times greater than the previous model CST, which in addition, employed twice as many cams for an identical switching sequence. The new timer HCST, incorporates wide contact blades and solid silver contacts to cater for heavy loads. Snap action contact piles have been employed with solid solder tags enabling external wiring to be directly connected to the units.

Driven by a synchronous motor geared to the cam shaft, the apparatus has been designed to control a continuously repeating cycle of operations but may be adjusted to stop after every complete or part of a cycle. By the choice of a suitable gearing, the total timing cycle can be arranged to last from between 1 second and 30 days. Each timing cam consists of two adjustable halves so that timing of all the intervals within the total available period may be altered as desired by turning the half-cams on the shaft. Standard operating voltages for the HCST range are 240 V 50 c/s single-phase or 440 V 50 c/s single-phase and for d.c. operation, the manufacturers offer timers HCST/D which are driven by d.c. motors.

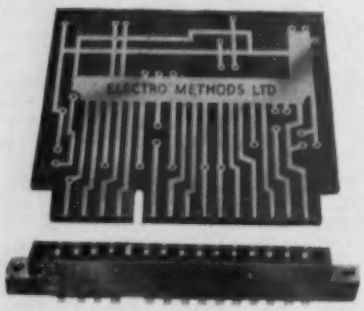
The HCST heavy duty multi-sequence timer has a switching capacity of 15 A at 240 V a.c.

Specialised Miniature Plug Range

THE completion of a licensing arrangement with an American company has enabled ELECTRO METHODS LTD., Stevenage, Herts, to commence tooling in preparation for the manufacture of a new range of high grade electrical components. Among the new products which will be available early next year are miniature and sub-miniature connectors, printed circuit connectors and stand-off terminal insulators.

Listed in six ranges from 7 to 50 pin, the miniature plug series, M.R.E., are mineral filled Melamine mouldings providing suitable mechanical and electrical properties. Pin and socket contacts are precision machined and gold over silver plated for low resistance and ease of soldering. Each contact has been designed to carry a maximum load of 7·5 amps and the d.c. breakdown voltage between pins with plug and socket coupled is said to exceed 3·7 kV at sea level.

Printed circuit connectors form a satisfactory method of linking conventional wiring to the printed system by simplifying identification of individual circuits and providing suitable tags for lead-off wires. These connectors, designated

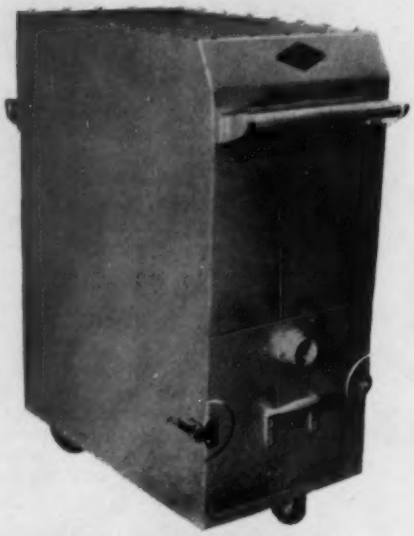


Electro Methods Ltd., include these printed circuit connectors in their new component range

series K, will be available in six types having from 6 to 22 contacts rated at 5 amps. The stand-off terminals included in the new range are moulded from asbestos filled Melamine and have a d.c. breakdown voltage in the region of 13 kV.

Heavy Duty Vacuum Cleaner

POWERED by a ¾ h.p. universal motor, the new industrial vacuum cleaner, EME 99, possesses a special filter and the facilities to provide a powerful blast of clean dry air. This equipment, built to a post-war design by POWERVACS LTD., 6 Cock Hill, E.1, dispenses with the conventional dust collecting bag by employing a metal bin and a constantly agitated filter. The advantages claimed by the use of this method are maintained suction, reduced possibility of clogging even when removing fine powders and the facility to empty the machine without developing dust clouds. Weighing 140 lb and standing 39 in. high, the equipment has been

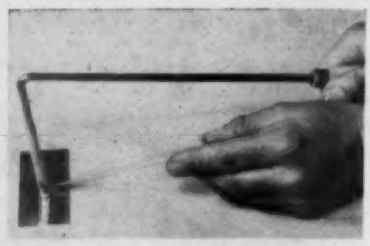


Powervacs' new heavy duty cleaner employs a special filter thus dispensing with the conventional dust bag

housed in a robust steel container mounted on two 7 in. rubber tyred wheels and a ball bearing castor.

Low Temperature Aluminium Soldering

THE possibilities of soldering aluminium at a temperature of 250° C have been investigated by TILTMAN LANGLEY LTD., 70 New Bond St., W.1, with the use of a specially developed solder. Joints of high mechanical strength and corrosion resistance have been claimed for this new solder, but the main advantage is said to lie in the relatively low working temperature safeguarding the alloys being joined against structural weakening. The tinning technique employs an electric hot plate for heating the work to the correct temperature and a tool containing a glass fibre brush in its extremity. Interchangeable brushes are available and each brush has an approximate life of 100 tinning operations. No flux is used on applying the solder, the molten solder merely being brushed over the aluminium surface and thus tinned whilst the work rests on the hot plate. Although the system is simple and effective, it would appear that it suffers certain limitations regarding application to soldering aluminium articles larger than the diameter of the hot plate.



Tiltman Langley's aluminium soldering tool contains an adjustable and interchangeable glass fibre brush

Glover No. 5 Health Lamp

A FLEXIBLE chrome-plated arm is embodied in the new Number 5 infra-red and radiant heat health lamp produced by STEPHEN GLOVER AND CO., Intown, Walsall.

This new model is sold tax free against medical certificate, is listed at £3. 9. 6d. It is finished in durable grey enamel and chrome and is supplied with a Stephen Glover 400 W mixed wave element.

From the home of "Verglo" conduit and accessories comes this health lamp

Siemens Introduce Clip-on Diffusers

CLIP-ON diffusers for bare fluorescent tubes have been introduced by SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38-39 Upper Thames St, E.C.4.

They are made of translucent polystyrene, each section 8 in. overall length, and can be coupled together to give "unbroken" continuity by means of automatic mortise and tenon assemblies. Suitable for any 1½ in. diameter fluorescent tube fixing is merely by push-fit. Packs of 7 sections for all 5 ft tubes are available at £1. 7s. plus 6s. 1d. tax. Packs of 6 sections cost £1. 3s. plus 5s. 2d. tax respectively.

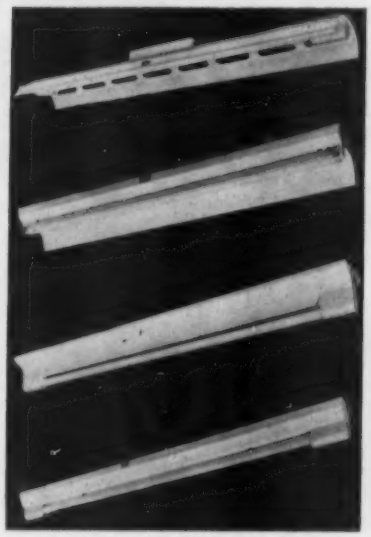
New Volex Accessories and Cables

INCLUDED in the new catalogue just received from VOLEX ELECTRICAL PRODUCTS LTD., Pendleton, Salford 6, Lancs, are two new accessories and a new range of cables. The accessories are both for plaster depth installation. The 13-amp sockets to B.S. 1363 are catalogued V/1304 and are available in brown or cream, and can be mounted in any box having ⅝ in. internal depth and fixing centres to B.S. 1299. The projection from the wall is only 7/16 in.

The range of 5-amp plaster depth switches V 501 and V 502 and combinations are complete with plates, being composite units allow self-adjustment to variations in the thickness of the plaster. Contacts are of silver-faced heavy-gauge copper, and all current carrying parts are mounted on ceramic base. These accessories are available in cream or brown in one-way or two-way, in one or two gangs and in multiples thereof. Moulded pattresses are available for converting any of the above items to surface mounting. The units and plates can be supplied separately on request and there is a range of intermediate switches to match the above.

There is also a 13 amp 3-way adaptor which can be readily re-fused without dismantling. This is catalogued V/1390 in Brown and V/1390 CR in cream.

New amongst the range of cables are p.v.c.-insulated cables made to B.S. 2004 and supplied in red, black, blue and white. All sizes from 1/·044 to 19/·064 are available. Twin twisted flexibles braided in either glazed cotton or art silk are made in sizes 14/·0076 to 40/·0076 to B.S. 7, 1953, Table 40. Three-core non-kinking circular flexibles, manufactured to Table 37 in the same B.S.S. are available in black, red and grey, in sizes 23/·0076 to 40/·0076, whilst a circular padded flexible in maroon glace cotton braid in twin and three core in all sizes from 14/·0076 to 70/·0076 and t.r.s. circular flexible in twin and three core in similar sizes.



From top to bottom: Stella Type SBL 604, SBL 485, SBL 602 and SBL 601

New Stella Lighting Fittings

ENTRY to the fluorescent lighting fitting market by the STELLA LAMP CO., LTD., 37/39 Oxford St, W.1, is marked by the introduction of ten "Blue Label" fittings.

There are ceiling batten, ceiling vee, industrial trough, slotted light through and angle reflector fittings for single 40 W, 4 ft and 80 W, 5 ft tubes, the prices range between £4. 5s. and £8 for the various models which are fitted with high power factor lapped ballast (200 V—250 V in 10 V steps); glow type two-pin cannister starter and higher quality cable and lamp holders. All fittings mentioned above are available with fixed ballast (230 V/240 V) at slightly reduced list price.

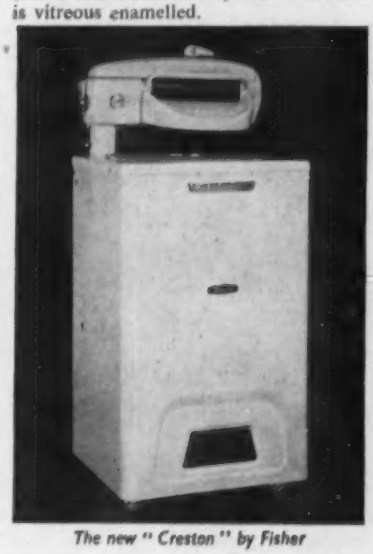
The origin of the "Blue Label" title is in the blue label which is attached to each fitting bearing the words: "This fitting is guaranteed against defective material or faulty workmanship." All Blue Label fittings are finished in high quality white stove enamel and are not subject to purchase tax.

For the Electrical Trade

"Creston" Latest Washer from H. Fisher

FOLLOWING on their absorption into the Hartley Baird Group, as announced on page 938. H. FISHER (OLDHAM) LTD., Oldham, Lancs, have announced the introduction of the "Creston," an all-electric washing machine of contemporary styling. Based on a conventional agitator principle the "Creston" is made to the same high standard of quality incorporating machine cut gears as other Fisher models in the past. A popular size model with generous capacity and fitted with full-size power wringer and power emptying pump this new model will cost £68. 10s. 3d. tax paid.

Approximately 6 lb dry weight of clothes can be handled by the machine which measures 34 in. x 21 in. x 21 in. Height with wringer is increased to 46 in. Finish is in hard gloss stove enamel in all cream, all white or in various two-tone colour schemes to special order. Tub is vitreous enamelled.



The new "Creston" by Fisher

NEWS OF THE WEEK

Simple Hire abolished from Jan. 1

East Midlands Consultative Council Strongly Protests

NO MORE new appliances are to be installed on simple hire terms after 1st January, 1956. This is another result of the Chancellor of the Exchequer's credit squeeze. Expansion of simple hire would, of course, tend to defeat the restrictions imposed on hire-purchase transactions, and would require a large amount of new capital for finance. Consequently it has been agreed nationally that both Electricity and Gas Boards will end the practice. The hire of existing appliances will continue to be maintained. The new restriction will cause no heartbreak in many areas, where the Boards have been gradually doing away with simple hire. Some Boards, however, find the system lucrative and continue to operate it. The announcement of the discontinuance of simple hire at last week's meeting of the E. Midlands' Consultative Council immediately promoted a resolution of protest. Expressing their great concern at the decision, the Council maintained that such facilities had always been regarded by them as a most desirable and necessary part of consumer service. They accordingly registered the "strongest possible protest" at the proposal, and asked the Board to pass on their protest to the C.E.A. Mr J. Mould, the Board's deputy chairman, told the Council that the Board regretted very much having to abolish simple hire. It came as bad news, he said.

A similar point of view may well be expressed by the N. Western Board, who, we understand, have found the system particularly good for boosting sales of water heaters. To illustrate an opposite point of view, however, we turn to the London Board. There, a recent representation by the Borough of Woolwich asking for hire facilities was turned down. The Board explained that whilst wanting to help consumers in that way, the present financial position and limitation of capital expenditure prohibited such action.

Plant Refresher Course in London Fully Booked

Shorter Courses in Southampton

THE Refresher Course for works and plant engineers in London and the Home Counties, organised by the education committee of the Incorporated Plant Engineers, has passed the enrolment records set up by previous courses held in other parts of the country. The course began at the Royal Empire Society last month. A total of 550 engineers enrolled and hundreds of further applications had to be refused as all available accommodation had been filled.

A shorter version of the same course is, however, being organised for engineers in Hampshire and adjacent counties. It will consist of 12 weekly lectures from the London syllabus given by the same lecturers, and will be held at Southampton University on Tuesday evenings, beginning on 17 Jan. Fee for the course is £2 2s., and copies of the syllabus, with full particulars, may be had from the Course Secretary, The University, Southampton.

Working Party to consider Supplies to Housing Estates

CONSIDERABLE progress has been made in the long-standing debate between Electricity Boards and Local Authorities on the supply of electricity to council housing estates. Meetings have taken place between the two parties and it has been decided to set up a working party to consider details. This was stated at last week's meeting of the Association of Municipal Corporations. Those who have been discussing the problem include Sir Henry Self; Mr J. Bellamy and Mr C. T. Melling, chairmen of the Yorks and Eastern Boards; Mr E. R. Wilkinson, commercial manager, Mr R. A. Finn, chief legal adviser, and Mr W. G. S. Thompson, assistant secretary of the C.E.A.; six representatives of the A.M.C.; and representatives of the Ministries of Fuel and Power and Housing. The working party has not been formed yet.

The problems involved are well known nowadays. Main points at issue are the minimum standard of wiring required by the Boards, and the question of freedom of choice of appliances.

Separate Subsidiaries

IT has been announced by Doulton and Co., Ltd. that their four main production branches will be given separate identities and operate as wholly-owned subsidiaries as from 1 Jan. next. Overall control of the business will continue to be exercised by the parent company in London. Among the new subsidiaries will be Doulton Industrial Porcelains Ltd. which will control electrical porcelain, chemical and general stoneware, filters and a number of other industrial ceramics made at Wilnecote Works, Tamworth. Managing director at Tamworth is Mr R. F. Lindop.

U.K. Cable Exports recover after Two-Year Decline

RECENT figures relating to trade in the cable industry, both in the export and home markets, present a very satisfactory picture of progress. Exports of insulated cable and wire have reached the highest level recorded in the past three years. They have totalled 75,000 tons in the Jan. to Oct. period of this year, an increase of 32% over the same months in 1954. Total production has been exceeding 1954 levels by over 25%, with most manufacturers working almost at full capacity. Main demand has been for telecommunications equipment. This situation is particularly pleasing after the fall in sales experienced since 1953 when output fell by some £18·3m and by a further £6·55m the following year.

As regards home sales, these too have maintained an increase on last year and in the first half of 1955 were up by some 20%. Commercial and industrial consumers, with the C.E.A. particularly prominent, are responsible for this rise in demand.

The post-war modernisation and expansion carried out within the cable industry, although a vital necessity, should be amply repaid in the coming years. World consumption of electricity continues to increase and should provide sufficient demand to maintain at least, the present high level of output. We understand, however, that productive capacity is not being increased generally in the industry, although there are numerous plans for development and re-equipment.

PLESSEY RESEARCH

FORMATION of another company within the Plessey Group, to be known as Plessey Research Ltd., has been announced. In recent years the Group has founded research establishments in various parts of the country on projects ranging from basic research to component development, and application research of various types. These activities have now reached a stage where it is necessary to unify control of all those units, it is stated. Chairman and managing director of the new company will be Mr A. G. Clark. With him on the Board are Messrs B. G. W. Attwood, E. J. Earnshaw, Michael Clark and G. C. Gant.

AUTOMATION LINK-UP

AN agreement has been concluded between the E.M.I. Group and the Cincinnati Milling Machine Co. of U.S., providing for the integration of the study and development of electronic machine tool control equipment. The American concern has a world-wide reputation for milling and copying machines, whilst E.M.I. cover all aspects of electronics, including automation, radar and navigation equipment and guided missiles.

OFFICIAL PUBLICATIONS

E.R.A. REPORTS

G/T297: Effect of Enclosure on Temperature Rise of Fuses, by H. W. Baxter, 10s. 9d.; L/T317: On Thermal Excitations of Trapped Electrons in Ionic Solids, by J. H. Simpson, 12s. 9d.; L/T318: Gas Temperature in Argon Spark Channels, by R. D. Craig, 6s. 3d.; Q/T124: Stray Losses in Transformer Cores, Critical Resumé, by S. Silbermann, 12s. 4d.; Q/T125: Stresses in H.V. Condenser-Bushings, by S. Silbermann, 12s. 3d.; W/T25: Applications of Electricity to Crop Drying on Farms, a Critical Review, by P. Finn-Kelcey, 25s.

MINES. Report of H.M. Chief Inspector of Mines for 1953. H.M.S.O. 3s. (See this page.)

FACTORIES. Report of Chief Inspector of Factories for 1954. H.M.S.O 18s. (See page 927.)

COURSES FOR ELECTRICAL TECHNICIANS. Report on. Published by I.E.E., 1s. (See page 920.)

Lord Chandos on Industry in Northern Ireland

B.T.H. planning Second Factory There?

CONSIDERATION is being given to the establishment of another factory in N. Ireland by the British Thomson-Houston Co., Ltd., Lord Chandos, the company's chairman, said in Belfast last week. Lord Chandos is also chairman of the N.I. Development Council. He said B.T.H. were seriously considering building a new factory in a different section of their industry, which would be self-contained and employ about 2,500. He described this as evidence of the company's faith and confidence in N.I., and went on to express the hope that U.K. industrialists would follow the example given. Lord Chandos's reference to further expansion in Ulster is understood to be part of the company's very long-term policy, and "any further publicity on the matter would be premature," a B.T.H. spokesman in this country informed us subsequently. Nevertheless, on leaving Ulster, the B.T.H. chairman is reported to have said that he would discuss the project with his director colleagues, but a definite announcement would not be made for at least three months.

It will be recalled that B.T.H. already have in hand the construction of an £8m steam turbine factory at Larne. It is proposed to design and manufacture steam turbo-generators ranging from 30,000 kW and upwards. The foundation stone of this new factory was laid by the Viscount Brookeborough, Prime Minister, on 29 Sept. last.

On the more general subject of industrial development in N.I., Lord Chandos said that the Council was confident that within a reasonable time, the back of the unemployment problem there could be broken. Substantial progress had already been made. Outlining the advantages to be gained by incoming industrialists, Lord Chandos said there was plenty of labour, while the rest of the U.K. was desperately short; and the difficulties of securing industrial sites were absent. There was nowhere else where anyone could work three shifts, he added.

Accidents Underground in 1953 is Lowest Recorded

ELECTRICAL accidents occurring in mines during 1953, which were considered in the ELECTRICAL TIMES of 1 Dec. last, are put in perspective against the general record of coal mining safety in the annual report for 1953 of H.M. Chief Inspector of Mines, published this week. During the year there were a total of 392 persons killed and 1,958 injured in reportable accidents. This total is the lowest recorded; and the accident rate per million tons of coal cut also fell. As stated in the earlier article, electrical accidents included three that were fatal, and 63 non-fatal accidents involving 64 persons.

In a review of the staffing situation in the Mining Inspectorate at the end of 1953, the Chief Inspector states that there were a principal and a deputy principal electrical inspector on the staff, and 7 electrical inspectors. There was a vacancy at the end of the year for one deputy electrical inspector. All in all, there were 37 vacancies in the inspectorate.

L.T.'s Special Mobile Crane can go by Tube

THE first of two specially-designed diesel-electric travelling jib cranes has now been put into service by London Transport. It is a compact unit weighing 36 tons. Special feature of the crane is that it can be hauled in train formation over the Underground network. The design presented numerous difficulties. It was required to be within the Tube load gauge and capable of slewing a complete revolution whilst having a tail radius which would clear cable posts and platforms, and offer minimum obstruction to traffic on adjacent tracks. Axle loading could not exceed 13 tons. The makers, Taylor and Hubbard Ltd., effectively complied with these specifications.

Hoisting, derricking, slewing and travelling are by means of independent 600 V motors, via reduction gearing. Power supply is provided alternatively from a diesel generator unit on the superstructure, and from a 600 V feed from the current rail of an adjacent track by means of collector shoes, trailing cable and power socket. The diesel engine is a McLaren M.R. 3-cylinder type with traction rating of 75 h.p. at 1,000 r.p.m., coupled to a 49½ kW compound wound generator made by Lancashire Dynamo and Crypto Co., Ltd. Electro-mechanical solenoid brakes are fitted to the hoist and derricking motions. Control gear was manufactured and supplied by V. G. Howell and Co.

London Transports new diesel-electric travelling jib crane. A second unit is on order

Threatened Strike

A TOKEN one-day strike on 2 Jan. is threatened by some workers in power stations unless the Central Electricity Authority agrees to a "substantial" increase in wages. This was decided upon at a meeting last week of an unofficial London Power Stations Combined Shop Stewards' and Works Committee. This action is intended to support the application by five unions for a wage increase, which has been under consideration by the C.E.A. for some time.

TRENDS IN ENERGY CONSUMPTION

ESTIMATING future needs for energy in Great Britain and the world generally is a necessary exercise in these days of intense forward planning. A new estimate was offered by Dr A. Parker, Director of Fuel Research, D.S.I.R., in the 1955 Melchett Lecture to the Institute of Fuel, which was delivered last week. He suggested that in the year 2,000, fuel and energy requirements in Great Britain will be equivalent to 300 million tons of coal a year, or rather more than 5 tons/head/year. For 2050, he puts the figure at 6 tons/head/year, with a total requirement of 350 million tons per year. On this basis the total consumption of fuel and power in Great Britain during the next 50 years would be equivalent to about 14,000 million tons of coal, and 30,000 million tons equivalent over the next 100 years. There should certainly be enough economically mineable coal in the country to meet the inland need for the next 100 years, provided the necessary labour can be found to undertake the required underground work, suggests Dr Parker. However, he does not consider that this latter problem and the associated need to increase output per man is likely to be solved in the near future. Part of the answer lies in expanded use of oil and part in the nuclear energy programme now being developed.

New Development in Hi-Fi Speaker Design

ON the basis of a paper recently presented to the British Institution of Radio Engineers by Mr H. J. Leak, it would appear that a loudspeaker of exceptional quality will shortly become available to "Hi-Fi" enthusiasts. This particular speaker is of the electrostatic type and was among those considered in the paper dealing with high-fidelity loudspeaker systems. It has been found that the electrical vibration of an infinitely stiff, massless plate produces the optimum conditions for perfect sound reproduction and it is upon this principle that the electrostatic speaker functions. In this case the plate is actuated by changing electrostatic fields instead of a moving coil actuated by a changing magnetic field as with conventional speakers. The principle of the electrostatic speaker has been known for approximately 30 years but development to a practicable stage has been retarded by constructional difficulties.

Now, however, by employing new materials and techniques, an encouraging degree of success has been attained. The speaker demonstrated consisted essentially of an extremely thin sheet of tough plastic having a negligible coefficient of thermal expansion and coated with an almost molecular thin film of conducting material. It will cost approximately £17 complete and will operate in conjunction with normal amplifiers. Mr Leak addressed the Institution's London branch on 30 Nov.

ILLUMINATED ESCALATOR

New idea at Swan and Edgar's store in Piccadilly Circus, London, is an illuminated escalator. Designed to inveigle customers from the ground floor to the first floor, the escalator's side walls have been constructed of armoured glass, sandblasted on the inside, and fitted into the walls is a reflector to which is attached a series of intermediate white cold cathode fluorescent tubes. General lighting over the escalator is provided by more cold cathode tubing in specially shaped ceiling coves. The idea originated with the store's directors and was carried out by the company's architect, Mr George Coles, in conjunction with the General Electric Co. and Waygood Otis Ltd. Installation work was by Higgins and Cattle Ltd.

Victoria Tube Line will involve Loss of £2¼ millions p.a.

THE proposed new London underground railway line between Victoria and Walthamstow—Route C—will be known as the Victoria Line, unless a better name is suggested. Speaking in London last week, Sir John Elliott said the Transport Commission was not yet committed to its construction, because it was a huge project and discussions on finance were still in progress. He had no doubt that the project would be undertaken, and went on to enumerate the line's many advantages.

On the question of finance, Sir John said the Line was expensive to build and could not pay its way in isolation. Annual interest charges on construction costs of £50m might be well over £2m. Net traffic receipts after deducting running costs, would be about £350,000. The Victoria Line, he said, would involve London Transport in a loss of about £2,250,000 a year.

Brighter Outlook

OUTPUT of electric lamps in this country has now reached about 250m a year, Mr Percy D. Oakley, Siemen's Preston manager, told fellow Rotarians.

Hartley Baird Enter Domestic Appliance Field

THE acquisition of H. Fisher (Oldham) Ltd., who have been in the hands of Receivers for the past three years, by the Hartley Baird Group, has been announced. Fishers' will continue to operate as a self-contained unit within the Group, and will continue also with the development and manufacture of electric washing machines and other appliances. The opportunity has been taken to develop a number of new designs, and as proof of this, the company announces immediately, the Creston washing machine. Details of this appliance may be found on page 935.

We hear that steps have been taken to improve servicing arrangements, and trade customers are being assured of a continual supply of spares for Fisher products. The acquisition of H. Fisher (Oldham) Ltd. marks a new departure for Hartley Baird. The purchasers already control companies specialising in electro-mechanical, electronic, radio and TV equipment and plastic materials, but they now enter the domestic appliance field.

Parsons Memorial Lecture

THE 20th Parsons Memorial Lecture was given on Tuesday evening at the Institution of Civil Engineers in London, by Sir Harold Roxbee Cox. In his lecture, Sir Harold reviewed the early history of the gas turbine and the parts played by the pioneers, especially Sir Charles Parsons. He described the more recent contributions of British and European engineers to the creation of the modern gas turbine, and went on to discuss ways in which it was applied as a prime mover in power stations, industry, locomotives, cars, ships and aircraft. Sir Harold concluded by referring to the main objective ahead, the nuclear energy gas turbine.

The First Half-Century

The Council of the Sheffield Chamber of Commerce has received a deputation from the Sheffield Electrical Contractors' Assoc. on the subject of municipal trading as carried on in the electrical fittings and wiring department of the Sheffield Corporation. The electrical traders are substantial ratepayers of the city, and by reason of the municipal competition to which they are subjected they have convinced the Chamber that it is impossible for them to carry on their business. The Chamber, therefore, passed a resolution recording its disapproval of the City Council carrying on the fittings and wiring department with public funds. The London electrical contractors have had a somewhat similar trouble in connection with the L.C.C., but so far their opposition has been successful. But the Sheffield firms seem to have very good grounds for complaint. Of course, the Sheffield wiring department is a legacy from the electric supply company, which was bought out many years ago by the Council at a big premium.—*From our issue of 14 Dec., 1905.*

Miss G. B. Becomes Mazda Queen of Light

HIGHLIGHT of the Mazda year—the election of the 1955 Queen of Light—took place in London on Monday evening. This is the second year that the competition has been staged, and for the final judging, the British Thomson-Houston Co., Ltd. took over the Lyceum dance hall. Of the 17 girls who paraded for sundry prizes, Mrs Jennifer Chimes of Leamington Spa succeeded to the title of Mazda Queen of Light.

The 17 comprised two teams of six from the North and South of England, two competitors from Scotland, one each from Wales and Ireland, and the eventual winner. Jennifer, a 22-year-old housewife won the Blackpool heat, but was unable to take part in the Area finals due to illness. She is, however, a holder of the Miss Great Britain title and consequently was allowed to compete on Monday evening. Apart from the title, Mrs Chimes also received a cheque for £100. Subsidiary prizes of either £15 or £50 were awarded to regional Queens of Light, depending on whether or not they were placed in the first six in order of merit, and £15 to any contestant in the first six who did not win a regional title.

Runner-up was Miss Maureen Killen, a Cardiff shop assistant; third Mrs Marjorie Scorer, a Newcastle clerk; fourth Miss Brenda Mee, a Tottenham model; fifth Miss Marlen Honor, a model from Ilford; and sixth Miss Audrey Windows, also a model, who came from Wembley but won the Morecambe heat while on holiday.

For the record, Queens of Light are elected annually in Scandinavia, and the ceremony is always held by the Swedish colony in London. Last Dec. the ceremony was revived in this country by the B.T.H. after 20 years. A condition of entry is that heat winners keep their hair blonde for a year.

Design of Electrical Equipment Outdated

THE electrical industry has been criticised for the way in which the design of equipment had failed to keep pace with the atomic age. The critic was Mr S. T. Walker, president of Birmingham Architectural Association. Speaking at the annual dinner of the Birmingham branch of E.C.A., he said electrical fittings were not up to standard when it was considered that the industry could produce an electronic computer. Mr Walker gave an amusing description of the apparent complexities and variations in the types of sockets and plugs commonly used in the home. He went on to advocate a standard single-holed socket (it can be done for telephone operators, he said) and made a serious appeal for greater simplicity in design. Finally, Mr Walker called for the co-operation of contractors in curbing building costs.

WHEN DAYLIGHT FAILS

THE switching of many illuminated signs in London's Piccadilly Circus is now controlled by daylight intensity. This has been achieved by the use of automatic photo-electric lighting control units MK.X made by Radiovisor Parent Ltd. The equipment incorporates a control circuit which is operated by the variation of natural daylight intensity on a photo-electric cell. When daylight deteriorates below a pre-set level, the signs are automatically illuminated. The unit consists of two weatherproof components, the photo-electric cell receiver and the control unit. Mounted in the latter is a chassis carrying a valve amplifier with power supplies, a control circuit relay and the sensitivity adjustment.

E.I.B.A. SOCIALS

Two northern branches of the E.I.B.A. held their annual social functions recently. Our top picture was taken at the Midland Hotel, Manchester. From left to right are Mr H. Etchells, hon. sec. of the local branch, Mr H. Cobden Turner, Lady Bishop, Mrs Cobden Turner, and Sir Harold Bishop, branch president. There were some 300 guests received by Mr J. Gibson, chairman, and Mrs A. S. Lowrey at the Northern Counties Area's 25th Annual Ball. Mrs W. R. Gledson is seen in the lower picture presenting a bouquet to Mrs Lowrey. Others in the photo are Mr Gibson, Mr F. C. Winfield, Miss Christine Parkin, and Mr A. Parkin

Assoc. for Producers of Technical Publications

MANY manufacturers and large undertakings now have technical publications departments of considerable size, and it will probably interest them to know of the Technical Publications Association, formed to promote the interchange of ideas between technical writers in industry. Establishment of the Association, whose offices are at 46 Brook St, London, W.1, resulted from the increasing number of handbooks and manuals issued by manufacturers nowadays to describe correct methods of operating and maintaining their products. In addition to publishing a newsletter to members, the Association arranges frequent meetings and lectures. One of its aims is to establish recognised standards of competency. As an important step in this direction, they are collaborating with the City and Guilds of London Institute and other educational authorities to establish national examinations and certificates.

Over 400 attended A.S.E.E. Ladies' Night

MORE than 400 members of the Association of Supervising Electrical Engineers and their guests were present last Saturday at the Park Lane Hotel, London, for the annual Ladies' Night of the Association. In the chair was Mr R. F. Mathieson, National Chairman of the Association, and there was a distinguished list of official guests, including the president, Mr Bryan Donkin. Speeches were short, as befitted the occasion, and they were limited to two. The toast of The Ladies was proposed by Mr Mathieson, a brief speech, and the response came from the Dowager Lady Swaythling (President, Electrical Association for Women). Lady Swaythling outlined the work that her Association carries out, making particular mention of the range of certificates in electrical knowledge which it grants. She also paid tribute to the success of the Electrical Engineers' Exhibition which the A.S.E.E. organises. Dancing and cabaret continued until midnight.

Northmet E.I.B.A.

THE annual meeting of the North Metropolitan branch of E.I.B.A. is to be held at Northmet Hse, Southgate, N.14, on 13 Jan. at 3 p.m.

Cooker Control Units for Singapore

THE city electricity dept. of Singapore have placed an order for 2,000 surface type cooker control units made by D.S. Plugs Ltd., of Workington. These units were put on the market only a short time ago, but substantial orders have already been received.

NEWS IN BRIEF

Members and guests at a dinner and smoking concert of the Electrical Trades' Commercial Travellers' Association held at the Windsor Castle Hotel, Victoria, last week, were entertained by Leslie Adams and Mary Gale, well known cabaret artistes.

Proceedings of the one-day Technical Information Conference on 27 Oct., which led to the formation of the Liverpool Scientific, Industrial and Research Library Advisory Council, together with a survey of the use made of Liverpool Technical Library, have been published in pamphlet form by Liverpool Public Libraries.

VHF sound broadcasting station at Pontop Pike near Newcastle is ready for service. The station will come into service next Tuesday (20 Dec.) and will transmit on 92·9 Mc/s, 88·5 Mc/s and 90·7 Mc/s. Transmissions will be horizontally polarised. From 15 Dec. there will be test transmissions starting at 9 a.m.

Long service of personnel with B.I.C.C. Ltd. is a tradition carried on from the two companies who merged to form the present organisation. A recent review up to last Oct. showed there were 73 employees with over 50 years' service and 528 with 40 or more years. In addition, about 100 pensioners have over 50 years' service to their credit.

Pye Telecommunications Ltd. have set up a communal business radio system at Meriden (nr. Coventry) the traditional centre of England. The business radio station, which is an extension of the police, taxi and ambulance radio-telephone schemes, is designed to enable industrialists to control their vehicles anywhere in an area between Leicester and Wolverhampton.

There were 150 people in a shop in Parker Lane, Burnley, during an auction sale of electrical apparatus when the floor sank and left a 6 ft cavity of sloping floor boards. None were injured.

Smiths of England Ltd. have supplied the Transantarctic Expedition with all equipment for recording time, speed and distance. Thermometers, heaters and sparking plugs have also been provided.

An American award has been made to the British firm, Plannair Ltd., we hear. It takes the form of a commemorative wall plaque and is presented by the American industrial publication *Design News* for achievement in modern design. The award is rarely presented outside the U.S.

ELECTRIC SUPPLY NEWS

Bexhill

All consumers in Bexhill are now on a 240 V a.c. supply, the conversion having been completed last week. In 1948 there were some d.c. consumers in the town, the outlying areas having been dealt with earlier by the Corporation undertaking. In 1952 the South Eastern Electricity Board approved a scheme, estimated to cost £100,000, and to take three years, to complete the changeover.

Cumberland

Local farmers still without a supply of electricity, are protesting that the recent cuts in capital expenditure will further delay hopes of connection. The Brampton branch of the National Farmers' Union has complained to headquarters about farms in outlying areas having been neglected. Mr J. E. Harrington, the National Farmers' Union representative on the board, has explained that the Board have had to stop rural development except in isolated cases, but by March next year the programme will be up to schedule. But Cumberland farmers are not satisfied, and protest has been made to their local M.P.

Dartmoor

The South Western Electricity Board's proposal to erect a new power line from Merrivale to Princeton was discussed at last week's meeting of the Devon Planning Committee, when several members expressed appreciation of the difficulty of the Board, considering the latter quite right in not agreeing to use underground cable. One member, Mr R. W. Turner, said he did not mind how high the radio mast was on North Hessary Tor, but he objected very strongly to lines of electricity pylons. The Dartmoor National Park Committee did not wish to deprive people of electricity, Major O. Allhusen stressed. The Committee had done its best to eliminate overhead lines at some of the worst places only. The chairman, Sir Henry Slesser, who is also chairman of the Park Committee, said the committee had a statutory duty to preserve the natural amenities of the park. If it considered something was proposed to disturb the amenities, the matter was sent to the Minister for an inquiry. The proposed new line was required for reinforcement of supplies. The earlier application by the Board for an overhead line had been rejected by the Minister of Fuel and Power, and the only dispute now was a narrow one, as to whether a certain section through a river valley should be underground or overhead.

Eriksay

The island of Eriksay received its first public supply of electricity last week by the North of Scotland Hydro-Electric Board. Power is taken via submarine cable from the Board's diesel generating station in South Uist. About 40 consumers have been connected up on the island.

Lincolnshire

A number of small villages in Lincolnshire may soon have a supply of electricity. Mr J. P. Tucker, sub-area manager to the East Midlands Electricity Board, has said that the Board are considering extending their existing 11 kV line from Frithville westwards to connect consumers in the vicinity of Gipsy Bridge, Langrick Bridge and Brothertoft. The Board are also considering extending the line at Chapel Hill southwards to connect several groups of properties.

Penrith

When members of a local authority voice protests at alleged delay in providing electricity supplies to nearby villages, there is usually a very good answer. Such is the recent case in which members of the Penrith Rural Council were concerned when, as we reported on 24 Nov., it was suggested that there had been "wire-pulling" to get a supply to the Outward Bound School at Hallstead, Ullswater, though people in the village of Watermillock, through which the line runs, had not been connected. Mr A. O. Johnson, chief commercial officer of the North Western Electricity Board, tells us that briefly the position is that it was necessary to take a 11 kV line to Hallsteads before the Board could give a supply of electricity to districts such as Watermillock en route. The original plan provided, after the establishment of this 11 kV "back-bone," for the connection by degrees of these other districts. This plan is being carried out.

LIGHTING SCHEMES

Bristol. A £9,200 scheme for lighting Hartcliffe Way has been approved by the Planning and Public Works Committee.

Heston and Isleworth. A stretch of lighting on the Great West Road is to be improved at a cost of £7,250.

Nelson. T.C. propose to spend a further £40,000 on street lighting improvements.

St. Helens (Lancs). The Lighting Committee has approved a £13,500 scheme for improved lighting of Marshall's Cross Rd district, involving 135 400 W lamps.

Scunthorpe. Major schemes of street lighting in the borough, estimated to cost £10,338, are to be carried out by the Corporation during the financial year 1956-57, subject to the necessary consents being forthcoming.

Wellingborough. M.o.T. is being asked to approve extension to street lighting at cost of £9,390.

QUESTIONS IN PARLIAMENT

Electricity or Roads

THE Chancellor of the Exchequer was asked last week if a proper balance of priorities was being kept between development of electricity and roads. Mr R. Gresham Cooke drew attention to the formation of gross fixed capital of £1,059,000,000 in electricity compared with £60 million on construction of roads between 1948 and 1954. Mr R. A. Butler agreed that great strides had been made with electricity and that progress with roads had been much slower, but could not accept that a proper balance of priorities had not been kept. Expenditure on roads would rise considerably under the new programme.

When Mr Gresham Cooke remarked that it would appear we had been going too fast in electrical development over the past six years, Lt-Col M. Lipton interjected by saying "not fast enough." Mr Gresham Cooke suggested, however, that spending some £200 million a year on electricity, already a heavily-loaded section of industry, tended to add to inflationary pressure. Mr Butler replied that the electrical development was needed to match industrial expansion. He agreed with Mr A. Woodburn that unless the worker received more power to his elbow, the country would not survive, however good the roads may be.

Investment Programmes

NO information was forthcoming from Mr R. A. Butler last week on the extent of cuts in capital expenditure planned by the nationalised industries. He said the programmes were still being reviewed. Mr G. Nabarro said he had been trying to get this information for four months, and asked if it could be given at least before Christmas, but Mr Butler would make no promises.

Purchase Tax

REPORTS and rumours concerning the possible introduction of a sales tax were disposed of in reply to questions last week. The Chancellor of the Exchequer said he had no ready-made scheme for a general sales tax. He added that members would be very unwise to underestimate the complexity and difficulty of introducing any such tax. Pressed by numerous questioners as to whether he intended to introduce a sales tax, later or in his next Budget, the Chancellor referred back to his original statement.

Select Committee

THE Prime Minister last week repeated his intention of making a statement soon about the situation arising from the special report of the Select Committee on Nationalised Industries. This was in reply to Mr G. Nabarro's query as to what steps were being taken to secure Parliamentary accountability for State electricity, gas, the A.E.A., and N. of Scotland Hydro-Electric Board in view of the abortive nature of the Committee's work. Mr H. Fraser suggested amending Standing Orders to increase the number of allotted supply days so that the extra time could be used to debate nationalised industries' activities. Sir Anthony said he did not think that was the right answer to the problem, and in any case asked Members to await his statement.

275 kV Grid

TOTAL route mileage of the 275 kV Grid Line so far planned was 2,180 miles, Mr L. W. Joynson-Hicks has told Maj Hicks Beach in a written answer.

Oil-Fired Stations

THE first dual-fired power station was expected to be running on fuel-oil before the end of the year, Mr L. W. Joynson-Hicks reminded Mr Slater last week. Mr Slater had asked how much coal had been saved following the Minister's appeal to the electricity supply industry to use oil instead of coal at power stations.

Hearing Aids

A COMPLAINT that light batteries for use with hearing aids were not available nationally under the National Health Service, was made by Mr S. S. Awberry. He was informed by Mr I. Macleod that the Mark II aid with batteries about half the weight of earlier models, were available everywhere. He added that an even lighter monopack model had just passed its clinical field trials and, it was hoped, would be available for children in about a year's time.

Scottish H.E. Power

A NUMBER of questions were put by Mr G. Nabarro last week on the N. of Scotland H.E. Board. He asked first for the aggregate installed capacity, kW.I, of stations under the Board as at 30 Nov., and the proportions of that aggregate in terms of water-, oil- and coal-fired stations. Mr J. Stuart replied with the following figures:

H.E. Plant	479,000 kW
Diesel Plant	43,300
Steam Plant (coal fired)	103,000
Aggregate capacity	625,000

Mr Nabarro asked then if legislation could be introduced to deal with the statutory borrowing limit of £200m imposed on the Board. He drew attention to the Board's expenditure of £117,300,000 on capital account up to 31 Oct.; a further £62,350,000 committed in respect of unfinished projects, and £2,155,000 for sanctioned schemes not yet begun, making a total of £181,805,000; and to the fact that schemes under construction would cost more than the sanctioned sums. Mr Stuart stated, however, that there was no immediate need to raise the £200m borrowing limit.

The next query by Mr Nabarro concerned the area of Loch Awe and the Pass of Brander. He asked if any steps had been taken to establish potential water-power resources, the cost of harnessing them, and the estimated potential installed capacity. Surveys in the Loch Awe area had been carried out, Mr Stuart said, both as regards a conventional hydro-electric scheme with an installed capacity of about 75,000 kW, and a pumped storage project of about 350,000 kW. No constructional scheme giving estimates of cost had been submitted.

Coal Appliances

IT was not practicable to make any estimate of the total savings in coal during the past three years by the adoption of modern grates or stoves, Mr L. W. Joynson-Hicks informed Mr R. W. Sorensen. He confirmed, however, that the increasing use of more efficient appliances was helping to make better use of coal.

Engineering Students

THE number of students who had enrolled for degree or equivalent courses in engineering and technological subjects in Scotland, and the proportion of foreign students, was asked for by Mr Malcolm MacPherson. The two figures were given by Mr J. Stuart as 2,014 and 243 respectively.

Advisory Service

TO what extent did the Ministry of Fuel and Power make tests to determine the advantages of electricity and gas for domestic purposes in order to guide the public in the choice of alternatives, asked Mr R. W. Sorensen. He was told that such tests were not carried out by the Ministry, but the N.I.F.E.S. provided for large-scale users advisory service.

Sayings OF THE WEEK

"In my opinion, a better way of dealing with this problem of overfull employment would be the introduction of a general sales tax in place of the present purchase tax, the rate to be varied when thought necessary." . . . MR J. F. LOCKWOOD, chairman of Electric and Musical Industries Ltd., told shareholders.

"There are far too many business managers with the idea that quality and British workmanship will sell goods without any attempt at salesmanship." . . . LORD MANCROFT, in the House of Lords.

"Some inspectors are concerned as to whether the same attention is being given to the training of women and girls as is given to that of men and boys, remembering that the former are often engaged on work of a safer character." . . . CHIEF INSPECTOR OF FACTORIES, in his annual report.

COMPANY ACTIVITIES

MR J. F. Lockwood presided at the meeting of Electric and Musical Industries Ltd. for the first time. It was held at the Connaught Rooms on Friday. He gave a full, and at times graphic, review of the group's affiairs, which as well as being world-wide, ranges from the latest mechanical entertainment devices to great "hush-hush" schemes for the Government. Mr Lockwood disclosed that total of the Stockholders' Funds employed in the business amounts to £13,599,000, of which £5,757,000 is employed in the U.K. and £7,842,000 overseas. He believes that purchase tax on a few articles should be replaced by a sales tax on everything sold over the counter, which could be varied as necessary. If every purchase made were taxed at the same rate he thinks there would be no fiscal incentive for consumers to buy one thing rather than another.

Sales of gramophone records in the year to June 30 last surprisingly rose 33% above the previous year.

E.M.I. is now benefiting from the past efforts to set up apprentice schemes, the results of which are now proving most important with the current general shortage of technical skill. To the apprentice scheme has now been added a programme of management training. Nearly 1,000 employees are in some form of apprenticeship, while E.M.I. Institutes Ltd. give over 5,000 students instruction in radio, television and electronics either by personal tuition or by correspondence courses. As regards the future, the group is planning for still further increases in sales, which were a record last year. From next January Capitol records will be sold in the United Kingdom. On one subject only did Mr Lockwood seem seriously concerned. That was the question of wage increases which affect the prices of goods which have to be sold abroad. Despite these difficulties, together with the restrictions on hire purchase, and the credit squeeze, he looks forward to the future with confidence.

J. H. Fenner and Co. (Holdings) are power transmission engineers, one of those useful handmaids of the electrical industry. Early in 1954 it was reorganised into a holding company which brought tax complexities which have made it difficult subsequently to assess the group's potentialities. During the past year, for instance, almost the whole of the profit earned was set aside for tax as happened in the previous seven months. But against this a substantial tax credit was brought into the 1953/54 accounts. It would now appear that the tax position has been cleaned up and that the next report will enable the company to be seen in a clearer atmosphere.

As far as can be ascertained dividends have not suffered in the change over. The latest payment, for instance, is 12½% on a capital increased by a 50% scrip issue last March. Leaving out special tax considerations, this dividend appears to be covered about seven times over. The cover is so good that it might be expected that the same rate will be maintained on the capital which is to be further increased by a one-for-three scrip issue. On this basis the 5s. Ordinary shares at 13s. 6d. yield about 6½%.—*From our City Correspondent.*

E. N. Bray Ltd.

It has been revealed that United Molasses Ltd. have purchased 96% of the Ordinary and Preference capital of £59,853 of E. N. Bray Ltd., manufacturers of electrical control gear, who were first formed in 1922. The purchase cost of the investment involves approximately £200,000 we understand.

Crompton Parkinson Ltd.

There were several causes why the company had had to close down the factory in New Zealand, Mr Albert Parkinson told an enquirer at the annual meeting last Thursday. In further explanation, Mr J. Harwood Fryer, joint managing director, said they found it better to manufacture many types of small articles in England and ship them to New Zealand. In fact, it was cheaper than in making them in the latter country where to do so satisfactorily they must have adequate protection.

Dewhurst and Partner Ltd.

Judging by the figures given in our accompanying table the directors may well consider that the past year has been one of progress, with a considerably increased turnover, and Mr M. Dewhurst, the chairman, adds that the year ended with a satisfactory value of orders in hand, both for home and overseas markets. Land has been secured at Amersham for urgently needed extensions which it is hoped will be in use next year. In addition minor additions are being made at Hounslow. These additions, together with extra plant, are being financed out of existing resources which have been set aside over the years for the purpose. The directors have also decided to seek permission to capitalise a further part of the reserves.

Year to 30 Sep.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	117,309	41,264	44	22½*	4/9	3/3
1952	172,735	52,476	55	19	5/4	3/11
1953	169,336	46,806	47	19	6/9	5/-
1954	179,399	74,448	75	24	7/9	5/1
1955	241,985	104,984	103	30	10/10	7/4

*Plus 200% capital bonus.

Electric and Musical Industries Ltd.

Competition in the export market is very strong and is likely to get stronger, Mr J. F. Lockwood, the chairman, warns. Total merchandise exports for the past year amounted to £4m. Plans for the future have been made in the belief that sales in most territories will show further increases. In the U.K. the full effects of h.p. restrictions and increased purchase tax are not yet known.

Year to 30 June	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	1,994,507	663,000	43	12	25/1	17/9
1952	1,626,377	402,365	20	12	18/11	12/6
1953	484,039	-284,079*	—	8	15/3	11/2
1954	2,059,000	479,000	22	10	27/7	11/3
1955	3,065,000	832,000	36	15	37/-	24/6

*Loss.

Palestine Electric Corporation Ltd.

The Ordinary dividend has again been passed. After charging taxation, etc, the profit for 1954 is £Is.96,723, compared with £Is.562,323 for the previous year.

Peto Scott Electrical Instruments

Turnover was 20% up for the year ended 30 June last, Mr C. F. Hollamby, the chairman, reports. This advance has continued and domestic sales to the end of Oct. last have proved a record. Mr Hollamby adds that the dropping of the sound radio side of the domestic programme and concentrating on the manufacture of television receivers has proved a wise policy.

Radio and Television Trust Ltd.

The bank overdraft and accrued interest was reduced from £588,583 to £39,247 at 31 Mar. last, while the cash holding improved to £31,705, it is shown in the full accounts. As a result of negotiations with the Trust's bankers, an adjustment of bank interest for previous years of £41,500 was made and refunded. The directors have also decided to defer for the time being consideration of proposals for a capital reconstruction scheme. The consolidated profit of £47,234 arises through the remaining operating subsidiary. The surplus of £184,085 on the sale of shares of Britannic Electric Cable Co. has also been brought in, with the net result that the adverse balance carried forward on the consolidated profit and loss account is reduced by £186,304 to £501,385.

Dividends Declared

British Insulated Callender's Cables Ltd. Interim 4% (2½%), but the increase is in order to achieve a more balanced distribution between the interim and final dividends.

Hick Hargreaves and Co., Ltd. Interim 5% (*same*).

Scottish Cables Ltd. Interim 7½% (*same*).

Max Stone. Interim 30% (*same*). It is stated that no final dividend will be paid in respect of the year ended 30 June last, for which interims totalling 50% have been distributed, but the directors are paying a first interim of 30%, as a year ago, for the twelve months ended 30 June, 1956.

B. S. and W. Whiteley Ltd. Interim 20% (*nil*).

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COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

16 Dec.—Christchurch T.C. Installation in 30 dwellings on Somerford estate.—See 1 Dec. issue.

16 Dec.—Macclesfield T.C. Class B sodium lighting units on concrete columns in Hurdsfield housing scheme and Palmerston Rd estate.—Advertised in 1 Dec. issue.

16 Dec.—Swinton and Pendlebury T.C. Installation in 80 houses in Clifton Development.—See 8 Dec. issue.

16 Dec.—West Ham B.C. Twelve electric vehicles for street cleansing.—Advertised in 1 Dec. issue.

17 Dec.—Dublin T.C. L.T. switchboard for Stanley St Depot.—See 1 Dec. issue.

17 Dec.—E. Anglia. Applications invited for inclusion in approved list of contractors.—Advertised in 8 Dec. issue.

17 Dec.—Preston T.C. Electrical equipment for Alston Hall College of Further Education.—See 1 Dec. issue.

17 Dec.—Selkirk T.C. Mercury discharge street lighting along trunk road A.7.—See 24 Nov. issue.

19 Dec.—Bedfordshire. Installation in county primary school at Goldington.—See 8 Dec. issue.

19 Dec.—East Riding. Installation in Hornsea county secondary school.—See 24 Nov. issue.

19 Dec.—N. Ireland. Electrical installation in 31 dwellings in Anne St, Portaferry, N.I. Housing Trust, 12 Hope St, Belfast. Deposit 10s.

19 Dec.—Musselburgh T.C. Steel columns with mercury discharge and sodium lamps.—See 24 Nov. issue.

19 Dec.—Tredegar U.D.C. Steel columns with sodium discharge lamps, brackets and lanterns for existing poles.—See 8 Dec. issue.

21 Dec.—Galashiels T.C. Group A mercury discharge lighting along trunk road A.72.—See 1 Dec. issue.

21 Dec.—Hawick T.C. Steel columns with mercury vapour lighting, equipment at Wilton Hill.—See 24 Nov. issue.

21 Dec.—N. Ireland. Installation at Princess Gdns school, Colinmore.—See 8 Dec. issue.

23 Dec.—Stranraer T.C. Mercury vapour lanterns with control gear wiring and concrete columns along trunk roads.—See 8 Dec. issue.

24 Dec.—Rayleigh U.D.C. Supply and erection of 70 25 ft columns with sodium lights along A.1015. W. F. Hadlett, Engineer and Surveyor, Council Offices.

28 Dec.—Bridgwater T.C. Concrete columns with sodium lamps, etc., for Relief Rd.—See 8 Dec. issue.

28 Dec.—Marshland R.D.C. Installation in 26 houses at Walpole St. Peter.—See 24 Nov. issue.

28 Dec.—Wandsworth B.C. Supply of Polythene insulated armoured cable. Borough Engineer, Municipal Buildings, S.W.18.—Advertised in this issue.

29 Dec.—Co. Down. Installation at Dundonald intermediate school.—See 8 Dec. issue.

29 Dec.—Kirkcaldy T.C. Installation in five shops and five maisonnettes in Links St.—See 8 Dec. issue.

30 Dec.—Hendon T.C. Sodium lamps, lanterns, transformers, condensers, etc., on concrete columns. Apply by 17 Dec. —Advertised in 8 Dec. issue.

30 Dec.—Kingston-on-Hull T.C. Light and power installation at Greatfield county primary school. City Architect, A. Rankine, City Hall. Deposit £1. 1s.

31 Dec.—Bristol. Electrical equipment for College of Technology.—See 1 Dec. issue.

31 Dec.—Cheshire. Applications for inclusion on official list for supply of lamps.—See 8 Dec. issue.

31 Dec.—Co. Louth. Electrical installation at Bush vocational school. J. V. Tierney, consulting engineer, 15-16 Duke St, Dublin. Deposit £3. 3s.

31 Dec.—Middleton T.C. Installation in 68 houses and 36 flats.—See 1 Dec. issue.

31 Dec.—West Riding. Contractors invited to apply for names to be included on lists of selected contractors.—Advertised in 17 Nov. issue.

31 Dec.—Worsley U.D.C. Supply and installation of electrical fittings for conversion of gas street lighting to electricity. L. T. Brown, Engineer and Surveyor, Town Hall, Walkden. Deposit £2. 2s.

31 Dec.—Wrexham R.D.C. Installations in 110 houses at Cefn, Esclusham Below, Gwersyld, Penycae and Ruabon.—See 1 Dec. issue.

2 Jan.—Finsbury B.C. Supply of electric lamps in year from 1 Apr. Borough Engineer, Finsbury Town Hall Annexe. Rosebery Ave, E.C.1.

4 Jan.—Stockton-on-Tees T.C. Supply of (*a*) 101 Group A concrete columns, and (*b*) same No. of 140 W sodium vapour discharge lamps, lanterns and ancillary equipment, for relighting trunk road A.19. Borough Engineer, Victoria Buildings, High St. Deposit £2. 2s. for each of (*a*) and (*b*).—Advertised in this issue.

6 Jan.—Dublin. Electrical installation at St. Mac Dara's National School, Carranoe, Co. Galway. J. Tyrrell, secretary, Eire Commissioners of Public Works, Dublin. Deposit £1.

7 Jan.—Dagenham T.C. Lamps, cables, conduit and accessories in year from 1 Apr.—See 8 Dec. issue.

9 Jan.—Bridlington T.C. Re-equipment of Burton Agnes pumping station with four sets of 25,000 g.p.h. horizontal electrically operated centrifugal pumping plant and ancillary equipment. Water Engineer, Marton Rd. Deposit £2. 2s.

9 Jan.—Lanarkshire. Supply of lanterns for 250 W mercury discharge lanterns, with chokes and capacitors for lighting trunk road A.8. County Lighting Engineer, 29 Clydesdale St, Hamilton.

9 Jan.—Romsey T.C. Provision of extra lighting points in 22 houses at Lansdowne Close. Borough Surveyor, Town Hall.

9 Jan.—Whitley Bay T.C. Supply of end tipping aluminium alloy pedestrian controlled electric vehicle for carrying road sweepings. G. Holden, Chief Sanitary Inspector and Cleansing Superintendent, Municipal Offices, Park Ave.

11 Jan.—Dublin T.C. Sewage pumps and electric motors and storm water pump and electric motor for Kilbarrack pumping station.—See 27 Oct. issue.

13 Jan.—Co. Limerick. Electrical installation at Limerick county courthouse. P. J. Sheahan, architect, 47 O'Connell St, Limerick. Deposit £10. 10s.

20 Jan.—Lincolnshire. Rewiring at St. George's Residential estate, Stamford.—See 8 Dec. issue.

26 Jan.—Belfast T.C. 33 kV and lower voltage cables and accessories.—Advertised in 8 Dec. issue.

27 Jan.—Belfast T.C. Five 33/6·6 kV 12,500 kVA outdoor stepdown transformers with on-load tap changing equipment.—Advertised in 8 Dec. issue.

No date stated—Ayrshire. Concrete columns; electrical equipment; lanterns for sodium vapour discharge lamps; and installation work, for trunk road A.78.—See 8 Dec. issue.

No date stated.—Liverpool. Supply of electric lamps for Fazakerley Group Hospitals Committee. E. A. Collins, Group Secretary, Aintree Hospital.

No date stated—Romford T.C. Lamps included in list of annual requirements. —See 8 Dec. issue.

No date stated.—N. of Scotland H.E. Board. Lighting, heating and 11 kV main

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 146 queries answered this week

"Mangnall-Irving" thrust borer, makers of? C.E.A.—Hydraulic Eng. Co., Ltd., Charles St, Chester.

"Localite" adjustable fittings, makers of? W.E.—Walter Grafton and Son Ltd., 122 Footscray Rd, Eltham, S.E.9.

"Nivoc" laboratory ovens, makers of? C.E.L.—Griffin and George Ltd., Kemble St. Kingsway, W.C.2.

"Woods" glass, makers of? A.T.A.—Chance Bros. and Co., Ltd., Lighthouse Works, Smethwick, Birmingham.

Medical wax baths, makers of? N.E.—Medical Supply Association Ltd., 53 Park Royal Rd, N.W.10.

Suspended lighting and heating unit for large rooms, etc., makers of? C.C.—Commercial and Domestic Heating Ltd., 138a Park View Rd, Welling, Kent.

"Orel" shavers, address for? G.N.—Siegrist (Orel) Ltd., 39 Berners St, W.1.

ANSWER WANTED

"Moccafina" coffee grinder, agents for? M.B.

and auxiliary cabling installations at Alltna-Lairige power station and Lairige dam. —See 8 Dec. issue.

No date stated—N. of Scotland H.E. Board. 11 kV indoor switchgear and ancillary equipment for Shin power station. —Advertised in 8 Dec. issue.

No date stated.—N. of Scotland H.E. Board.—Supply and erection of 132 kV isolators, 33 kV switchgear, neutral earthing resistances and ancillary equipment, for Persley substation. Merz and McLellan, 72c George St, Edinburgh. Deposit £2. 2s.—Advertised in this issue.

. . . and Overseas

Details of items marked • may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.

29 Dec.—Rhodesia and Nyasaland. Supply, erection, two 4-motor overhead electric travelling cranes for Kariba power station. Details to both the secretary, Federal H.E. Board, P.O. Box 630, Salisbury, S. Rhodesia, and Merz and McLellan, Carliol Hse, Newcastle-on-Tyne.—Advertised in 8 Dec. issue.

30 Dec.—India. Supply of 757 distribution transformers; 22 kV and 11 kV, voltages of 50, 75, 100, 150 and 250 kVA capacities. Govt. of Madras Electricity Department, 157 Mount Rd, Madras. B.o.T. (Ref.: ESB 26207/55).•

4 Jan.—India. Manufacture, erection, etc., five 180,000 lb p.h. water tube boilers with ancillary plant for Korba power station. Madhya Pradesh Electricity Board, New Castle Building, Seminary Hills, Nagpur. B.o.T. (Ref.: ESB 25031/55).•

4 Jan.—U.S.A. Supply and installation of one 11,250 kW 6,900 V 3-phase 95% power factor 225 r.p.m. 60 cycle vertical shaft a.c. air cooled generator, for Roza power plant, Yakima; also of two 13,333 kVA 90% power factor, 180 r.p.m. 6,900 kV 3-phase, 60 cycles vertical shaft a.c. generators for Glendo power plant, Wyoming. U.S. Dept. of Interior, Bureau of Reclamation, Denver Federal Centre, Denver 2, Colorado. Separate contracts. B.o.T. (Refs.: ESB 26129/55 and ESB 26126/55).•

5 Jan.—South Africa. Tenders invited for supply of 27,720 yd of p.v.c. switchboard cable. Union Tender and Supplies Board, 291 Bosman St, Pretoria. B.o.T. (Ref.: ESB 25356/55).•

14 Jan.—Rhodesia and Nyasaland. Supply and erection of 330 kV cable and ancillary cables; shunt compensating reactors; and main and auxiliary switchgear, for Kariba Hydro-Electric scheme. Details of qualifications, etc. to Secretary, Federal H.E. Board, P.O. Box 630, Salisbury, S. Rhodesia, and Merz and McLellan, Carliol Hse, Newcastle-on-Tyne, by above date.—Advertised in this issue.

15 Jan.—Iraq. Supply of transformers, switchgear, outdoor circuit-breakers, copper conductors, underground cables, joint boxes, poles, h.t. and l.t. insulators, etc. Copy of documents available from Electricity and Water Board Mosul. B.o.T. (Ref.: ESB 25576/55).•

18 Jan.—Belgian Congo. Supply, installation, etc., of luminous landing beacons at Leopoldville aerodrome. Specif. 850. Documents from Service des Approvisionnements du Ministere des Colonies, 1 rue de la Regence, Brussels. B.o.T. (Ref.: ESB 25847/55).•

18 Jan.—Uruguay. Tenders (No. 2422) invited for 17,800 lengths of flexible cord for telephone apparatus. Usinas Electricas y los Telefonos del Estado, Montevideo. B.o.T. (Ref.: ESB 25776/55).•

23 Jan.—India. Supply and erection of 96 miles of 66,000 V 3-phase double circuit transmission line with A.C.S.R. conductor size 0·1 sq in. copper equivalent between Salawa-Muradnagar-Sumera substation of Ganga Hydel Grid. Forms at Rs. 15 from Superintending Engineer, Hydel Ganga Circle, Roorkee.

26 Jan.—New Zealand. Supply of 30 vacuum cleaners, 12 blower and suction tools and 24 floor polishers for N.Z. Post Office. Tender No. P. and T. 150/8456. Director General (Stores Div.) G.P.O., Wellington. B.o.T. (Ref.: ESB 25979/55).•

27 Jan.—India. Various transmission line material, including insulators, conductor accessories, line, tools, capacitors, etc., required under I.C.A. Procurement for India. Project SE/4065/F. Director General Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (Ref.: ESB 26023/55).•

31 Jan.—India. Supply of 33 kV solid type supertension cables and accessories for Howrah Grid substation. Tender E.D. 719-2. Dep. Chief Electrical Engineer (E. and R.), Damodar Valley Corpn., Anderson Hse, Alipore, Calcutta. B.o.T. (Ref.: ESB 25845/55).•

3 Feb.—Nicaragua. Bids invited concerning National Power System, involving 30 MW thermo-electric power plant, expansion and renovation of existing distribution systems in Managua, and about 110 miles of 69 kV transmission lines, 57 miles of 13·2 kV lines, 6 receiving substations, one sending substation, and distribution systems for 15 towns. Empresa Nacional de Lux y Fuerza, c/o The Kuljian Corporation, 1200 North Broad St, Philadelphia 21, Pennsylvania, U.S. B.o.T. (Ref.: ESB 14277/55).•

13 Feb.—Iraq. Supply, erection, etc., of three each 15,000 kW turbine generator sets at Dibis power station, and two each 20,000 kW turbine generator sets at Baghdad power station. Documents from Iraqi Embassy in London.

29 Feb.—India. Supply and installation of four turbines and one house turbine-generator. Central Purchasing Officer, Govt. of Bombay, Old Custom Hse Yard, Bombay. B.o.T. (Ref.: ESB 26274/55).•

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 13 December

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	401	+8	277
„ (3 months)	394	+14	265½
R.S.T. (Rhodesian Selection Trust) group price*	360	—	—
LEAD, refined pig, min. 99·97% purity (cash)	114	+2½	103½
„ (3 months)	113	+2½	103
TIN, refined, min. 99·75% purity (settlement)	840	+27½	713
„ (3 months)	825	+24	713
ALUMINIUM, ingots 99·99·5%	171	—	156
ZINC, virgin, min. 98% purity (cash)	99½	+½	84
„ (3 months)	96½	+1½	83
RUBBER No. 1, RSS, spot (per lb.)	37d.	−2d.	24¾d.
„ c.i.f. basis, ports, Jan. (per lb.)	36½d.	−¾d.	24¾d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	56½	—	52½
Mild Steel Tape (0·04 in.)	43½	—	40½

(*Fixed price c.i.f. U.K., now subject to change at 24 hours' notice, to "consumers willing to instil a degree of stability into the resale price.")

Contracts Placed

Cheadle and Gatley U.D.C. Supply and fixing 150 Group B concrete street lighting columns and brackets, Stanton Ironworks Co., Ltd.

Darlington T.C. Lighting improvements at Albert Rd boys' school, J. Paterson and Co., £1,366. Installation at new Haughton secondary modern technical school, Doves Ltd., £9,973.

Durham. Electrical installation at Hartlepool Baltic St county school, R. V. Hogg and Co., £1,847; same at Seaham Harbour Deneside county school, Armstrong and Ryan, £2,785; and at W. Pelton county infants' school, T. Mitchelson (Electrical) Ltd.

Glasgow T.C. Electrical installation in primary school at Drumchapel, James Scott and Co. (Electrical Engineers) Ltd., £11,756; same at Ruchazie, Claud Hamilton Ltd., £3,811.

Isle of Ely. Electrical installation in new high school, Ely Electrical Co., Ltd., £7,220.

London. Flow-metering equipment and instrument panel at Northern Outfall Works, Beckton, George Kent Ltd., £41,181; renewal of main switchboard and distribution boards at Luxborough Lodge, St. Marylebone, William Steward and Co., Ltd., £2,065. Manufacture, supply, etc., electric passenger lifts on various housing estates, Express Lift Co., Ltd., £310,000.

Middlesbrough T.C. Installation in 13 shops and 18 flats on Park End estate, N.E. Electricity Board.

Thornaby-on-Tees T.C. Erection of street lighting columns in Lanehouse Rd, B. L. Oliver, £2,841.

Wallsend T.C. Electrical installation at Addison Potter school, Electric Equipment Ltd.

Trade Notes

Change of Address. Tubela Engineering Co., Ltd., have moved to Fowler Rd, Hainault, Essex. Telephone: Hainault 4426.

Expansion. Dowding and Mills Ltd. have now started their own electrical contracting organisation in Birmingham, with Mr J. Robinson as manager of the department.

Extensions. At a cost of over £35,000 extensions have been completed at the New Ross premises of the Irish Driver-Harris Co., Ltd.

BUSINESS PROSPECTS

Home

Alnwick R.D.C. It is proposed to erect 34 houses and six bungalows. Site plans approved. Council's Architect, T. J. Cahill, Lloyds Bank Chambers.

Bebington T.C. Erection of 48 flats in three 3-storey blocks in Town Lane. Borough Engineer and Surveyor, Municipal Offices.

Belfast T.C. Tenders may soon be invited for erection of multi-storey flats at Annandale Embankment.

Beverley T.C. Plans in hand for new bank premises and offices at Saturday Market for National Provincial Bank Ltd.; and for single storey factory building proposed by Deans and Son (Yorkshire) Ltd., Grove Hill.

Boldon (Dur). Two-storey extension to their offices proposed by Gordon Durham and Co., Ltd., Moor Lane, East Boldon.

Bury St. Edmunds. Van Melle, of Rotterdam, are to build factory on municipal trading estate, Newmarket Rd. Quantity surveyors are Thurgood, Son and Chidgey, 2 Broad St Buildings, London, E.C.2.

Cardiganshire. Erection of primary schools at Cwrtnewydd and Trewen. G. R. Bruce, County Architect, County Hall, Aberayron.

Chepstow R.D.C. Construction of 50 houses and 8 bungalows on Rogiet site. Thomas Morgan and Partners, Council's Architects, 23 Gelliwastad Rd, Pontypridd.

Chester-le-Street R.D.C. It is proposed to build 198 houses at Great Lumley. Architect is R. Bowman, Estate Office, Birtley.

Doncaster T.C. Plans provisionally approved for new civic centre. F. Gibberd of 8 Percy St, London, W.1, is architect.

Durham. County Council considering erection of secondary school at Newfield, Chester-le-Street.

Gazette Announcements

Noble and Gregory Ltd. Last day for receiving proofs in respect of intended dividends, 23 Dec. Liquidator is T. H. Parker, Official Receiver and Liquidator, Govt. Buildings, 10 St. Mary's Sq, Swansea.

William Gartside Ltd. Resolution for voluntary winding-up passed at meeting on 24 Nov., when H. Whitehead, of 1-4 Clarence Arcade Chambers, Ashton-under-Lyne, was appointed liquidator.

Multi-Ray Heaters Ltd. Creditors are asked to send particulars to liquidator, Roy Lawrence of 4 Waterloo St, Birmingham, by 31 Dec.

BANKRUPTCY ACTS

Order on Application for Discharge

Gloucester. Walter E. Sparrow and Florence Sparrow, trading as Sparrow and Co., electrical contractors, at 8 Longsmith St, Gloucester. Date of order, 17 Nov. Discharge suspended for one month, and that they be discharged as from 17 Dec.

Appointment of Trustee

Worcester. Frank Simons, electrical contractor, of 15 The Council Hse, Winchcombe Rd, Sedgeberrow, Evesham. Trustee is R. F. Bendall, C.A., 126 Colmore Row, Birmingham 3

Receiving Order

St. Albans. Burrough Electric Co., electrical engineers and contractors, of 1 Church St, Watford. Date of receiving order, 1 Dec.

Eastbourne. British Syphon Co., Ltd., Barnsbury St, London, N.1, are anxious to build factory on Brampton Rd trading estate.

Essex. Programme of fire service building for 1956-57 has been approved. Total cost of some seven schemes is £153,000.

Evesham (Worc) R.D.C. Following housing schemes proposed: 20 houses at Harvington, 15 each at Pebworth and Childswickham; 12 at Bretforton; 10 each at Broadway and Wickamford; eight at Cleve Prior, six each at Ashton-under-Hill, Inkberrow, The Littletons, Rous Lench and Sedgeberrow; and two at Abbots Morton.

Hebburn. Durham C.C. to negotiate for purchase of sites for five nursery schools and a primary school.

Hemel Hempstead. Factory and offices being planned for T. Foxall and Sons, London, N.W.1. Cost will be about £50,000. Cleeds, of 106 Regent St, W.1, are reported as quantity surveyors.

Hexham U.D.C. Consideration being given to erection of 60 flats on Causey Hill estate.

Hull. Application to be made to borrow £266,000 for completion of central police station.

Hyde. Plans submitted for new factory and offices in Junction St for T. Brown and Co., Ltd.

Ilford T.C. Revised scheme in hand for erection of 78 flats in two 10-storey blocks, 24 in a 6-storey block, 40 in two 5-storey blocks, 30 in three 3-storey blocks, 12 maisonnettes in a 4-storey block, 16 old people's flats and 53 houses on Loxford estate. Estimated cost £180,700.

Ipswich T.C. Erection of 38 houses on Chantry estate. Borough Engineer and Surveyor, 19 Tower St.

Kidderminster. Factory and offices in Stourport Rd, proposed by National Standard Co., Ltd.

Lambeth. Plans approved for school equipment depot at Upper Kennington Lane which is estimated to cost £222,160.

Lancashire. R.C. secondary school at Walton-le-Dale and secondary school at Longridge have been included in 1956-57 building programme. Costs are estimated at £111,425 and £105,250 resp.

Leeds T.C. Erection of 202 dwellings on Belle Isle estate. City Architect, Priestley Hse, Quarry Hill.

Leek (Staffs) U.D.C. Plans to be prepared for erection of 70 houses on Haregate estate.

Leicester T.C. It is proposed to invite tenders next year in connection with slum clearance programme and erection of 1,200 dwellings in redevelopment areas.

London. Littlewoods Mail Order Stores Ltd., of 213 Oxford St, W.1, are to extend their 197-205 Oxford St. stores. Architects are Robert Sharp and Son, 13 Lower Belgrave St, S.W.1.

Also, Feinex Financial Holdings Ltd. to erect factory and office in Fetter Lane, E.C.4. Surveyors are C. T. R. Kelly and Partners, 36 Seymour St, W.1.

Maidenhead T.C. Erection of 20 houses on Spencers estate. Borough Engineer and Surveyor, 14 Cranford Rise.

Manchester T.C. Erection of about 161 houses and 36 maisonnettes and flats at Bredbury. Director of Housing, Town Hall.

Mansfield T.C. Tenders may soon be invited for erection of two blocks of flats in Nursery St.

Middlesbrough. Inclusion of basement in Newcastle Hospital Board's plans for new accident wing at General Hospital will cost about £28,000 more.

Newcastle-on-Tyne. Following architects have been appointed: Turley and Williamson, 46 Jesmond Rd, for county primary school on Montague estate, and L. J. Convers and Partners of Carliol Hse, for secondary technical school in Stamfordham Rd.

North Shields. Showrooms to be built by Coast Rd Motor Co., of Queen Alexandra Rd. Architect is R. Walton of Shorlley Bridge, Co. Durham.

Also, architect for the Major Equipment Ltd.'s factory in Bird St, is L. G. Wood, 17 Northumberland Sq.

Nuneaton. Factory in Weddington Rd proposed by J. V. Finn Ltd., of Hosiery St, Bedworth. Architects are Brown and Sharp, 2 Station Rd, Hinckley. Plans in hand also for factory in same area for Abbott Hosiery Co., Ltd., of Trinity Lane, Hinckley.

Paddington. E. A. Stone, Toms and Partners, 28 S. Audley St, W.1, are architects for two blocks of offices, and underground car parks.

Peterborough T.C. First stage of Paston-Gunthorpe housing site provides for 280 dwellings with church and public house sites.

Plymouth. Ministry approval sought for erection of £100,000 factory at Whiteleigh for lease to C. and J. Clarke Ltd., of Street, Somerset.

St. Pancras. Shops and offices to be built in Pentonville Rd. Architects are E. A. Stone, Toms and Partners, 28 S. Audley St, W.1.

Sligo (Eire). Approval given to erection of 41 dwellings in Tubbercurry, six each at Rhue, Ballymote and Sligo, and nine at Dromore West.

South Shields. Revised sketch plans approved for second instalment of proposed Marine and Technical College. Architects are Meade, Taylor and Wilson, 17 Sheffield Terr, Camden Hill, London, W.8.

Also, the Newcastle Hospital Board recommended to erect theatre suite at General Hospital costing £14,000, and to carry out improvements at Ingham Infirmary costing £25,000.

Stevenage. Factory on north side of Six Hills Way proposed by Mentmore Manufacturing Co., Ltd., Platignum Hse, Tudor Grove, London, E.9. Architect is H. C. Constantine, 28 West St, Marlow, Bucks.

Walthamstow T.C. It is proposed to erect 313 dwellings on 18 sites next year.

Watford T.C. Further contracts may soon be placed for erection of 200 houses during 1956.

Overseas

Mexico. Mr G. A. Grobien of McMains y Grobien, Apartado 50, Monterrey, Nuevo Leon, Mexico, has stated that a local steel mill imports annually from U.S. and Germany at least $180,000 worth of electrodes for their electric furnaces, and feels that if his firm had representation of U.K. manufacturer he could divert some business to U.K.

Uganda. Electronics Ltd., P.O. Box 1869, Kampala, want to represent on a purchasing basis U.K. makers of electrical household appliances including irons, toasters, hair dryers, coffee percolators and hot plates, and also tape recorders and record tapes.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Norman Fifield Ltd., 51 Altyre Way, Beckenham, Kent. Dealers in furnishing goods and household utensils, electrical, wireless or television goods, etc. Nom. cap.: £100. Dirs.: E. N. Fifield and Mrs D. E. Fifield.

Collimat Development Co., Ltd., 32B Plumstead Rd, Woolwich, S.E.18. Mechanical, electrical and general engineers, tool makers, etc. Nom. cap.: £1,000. Dirs.: G. J. L. Tyler and L. J. L. Tyler, H. F. Collier and C. Mann.

North-Western Electronics (London) Ltd., 47 Dunstan Rd, N.W.11. Manufacturers of and dealers in electrical goods, wireless and television sets, etc. Nom. cap.: £1,000. Dir.: J. Nunes.

W. J. Redman Ltd., 65 Tarrant St, Arundel, Sussex. General electrical and radio and television engineers and contractors, etc. Nom. cap.: £1,000. Dirs.: W. J. Redman and A. C. Redman.

C. G. Lu-Vac Ltd., 39-41 Carrs Lane, Birmingham 4. To take over business carried on as "Lu-Vac Domestic Appliances" at Birmingham. Manufacturers of and dealers in domestic, kitchen and general household utensils, general domestic equipment, vacuum cleaners, washing machines, etc. Nom. cap.: £3,000. Dirs.: W. F. Cowley and E. A. L. Groves.

E. Sockett Ltd., 115 Carlisle Rd, Sheffield. To take over business of electrician and dealers in radio, television and electrical apparatus, carried on at Sheffield as "E. Sockett." Nom. cap.: £3,000. Perm. dirs.: E. Sockett and Mrs L. Sockett.

Featherfoam Ltd., 59 Sloane St, S.W.1. Manufacturers of and dealers in domestic, household, electrical, fancy goods, and clothing of all kinds, all materials and articles composed wholly or partially of synthetic and/or natural rubber, and all types of plastic and allied materials, engineers, etc. Nom. cap.: £1,000. Dirs.: C. W. Simes and Hetty Gilbert.

Cresta Electronics Ltd., The Parade, Deepcut Bridge Rd, Blackdown, Hants. Manufacturers of and dealers in radio, television and electronic equipment, etc. Nom. cap.: £1,000. Dirs.: C. N. Stuart, A. S. Harrington and S. Goldsmith.

Specialised Components (Yorkshire) Ltd., 279 Anlaby Rd, Hull. To take over business of sale and distribution of car batteries, brake linings, clutch facings, fan belts, ignition components, cables, auto and electrical engineers, auto and household lamp wholesalers, battery building and repair service, etc., carried on at Hull, Bridlington and Scarborough by Wilfred W. Lowsley and Norman Cooper. Nom. cap.: £10,000. Dirs.: W. W. Lowsley and N. Cooper.

Magnamat Ltd. Manufacturers of and dealers in equipment and materials designed for use in non-destructive testing to detect surface discontinuities and other defects, in determining concentration of stresses in rigid members and thickness of materials and coatings, and in detecting flaws, etc. Nom. cap.: £100. Dirs.: not named. Subs.: W. L. V. Harrison, 10 Girton Rd., Sydenham, S.E.26; and J. Somerville, 3 St. Mary's Ave, Shortlands, Kent.

L. and I. Clarke Electrical Co. (Portslade) Ltd. To take over business of manufacturers and wholesalers of lampshades and electrical fittings carried on as "L. and I. Clarke" at The Red School, West Rd, Portslade, Brighton. Nom. cap.: £1,000. Dirs.: L. W. Clarke and Ivy A. G. Clarke, 82 Cross Rd, Southwick, Sussex; A. Levy and L. Caplin.

Fielden Research Ltd., Paston Rd, Wythenshawe, Manchester, 22. Scientific researches, investigations and experimental work in particular in connection with electronics, nuclear physics, etc. Nom. cap.: £1,000. Permt. dir.: J. E. Fielden.

Sew-Vac Ltd., 432 Barking Rd, East Ham, E.6. Manufacturers of and dealers in domestic appliances, etc. Nom. cap.: £1,000. Dirs.: E. A. Wade and Mrs L. Wade, F. H. Hutchins and Vera A. Hutchins.

Securalarms Ltd., 30 Queen Anne St, W.1. Electrical, gas, marine, hydraulic, aeronautical, pneumatic, ventilating, heating, chemical and general engineers, etc. Nom. cap.: £100. Dir.: I. Ergus.

Netherburn Ltd., Manufacturers of and dealers in electrical and neon signs, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jean Herbert and T. A. Herbert, 156 Strand, W.C.2.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Elequip. 745,575. Class 7. Generators and pumps. Electrical Equipment Co. (Leicester) Ltd., 106 London Rd, Leicester.

Ever Ready. 735,595. Class 9. Semiconductors for use in electronic apparatus. Ever Ready Co. (Gt. Britain) Ltd., Hercules Place, N.7.

Remocco. 744,085. Class 9. Floor polishers and vacuum cleaners. Fillerys (Gt. Britain) Ltd., 101/109 Ladbroke Grove, W.11.

Airsonic. 744,618. Class 9. Stethoscopes for use in detecting faults in machines. Murchie Trading Co., Ltd., 11 Kings Rd, Sloane Sq, S.W.3.

Electrostar. 745,346. Class 9. Suction cleaners and floor polishers, etc. Bylock Electric Ltd., 109 South St, Enfield, Middx.

Dunlobat. 745,402. Class 9. Batteries and accumulators. Dunlop Battery Co. (Ayrshire) Ltd., 9 St. Dunstans Hill, Sutton, Surrey.

Optronics. 745,214. Class 9. Hearing aids. Bonochord Ltd., 48 Welbeck St, N.1.

Calomatique Z. 745,384. Class 11. Heating elements. Electric Bedwarmers Ltd., Quality Works, Commercial St, Hebden Bridge, Yorks.

Zentramatic. 745,152. Class 7. Drying machines. Hotpoint Electric Appliance Co., Ltd., Crown Hse, Aldwych, W.C.2.

MEETINGS TO NOTE

THURSDAY, 15 DEC.

I.E.E. (London Utilisation). "Intensification of X-ray Image in Industrial Radiology." A. Nemet and W. F. Cox. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Lancs). "Automatic Circuit-Reclosers." G. F. Peirson, A. H. Pollard and N. Care. Elect. Offices, Finkle St, Kendal, 7.15 p.m.

I.E.E. (Irish). "Germanium Transistors." R. McCormick. Trinity College, Dublin, 6 p.m.

I.E.E. (E. Midland). Faraday Lecture: "Coal Mining Electrically." B. L. Metcalf. Albert Hall, Nottingham, 7.15 p.m.

I.E.E. (E. Anglia). "Industrial Application of Radio-Active Isotopes." S. Jefferson. Assembly Hse, Norwich, 7.30 p.m.

I.E.E. (Southern). Annual dinner and dance. Polygon Hotel, Southampton, 7.30 p.m.

A.S.E.E. (Kent). Social evening at Highfield Hse, Maidstone, 8 p.m.

A.S.E.E. (Nottingham). A convivial evening at Cross Keys, Byard Lane.

A.S.E.E. (Watford). "A Day in the Life of a D.C.E." W. B. Askew. Clarendon Hotel, Station Rd, 8.15 p.m.

Chelmsford Engineering Soc. "The Helicopter and Its Developments." Dr G. S. Hislop. Crompton's Hall, 7.30 p.m.

Inst. of Fuel (Mersey). "Instrumentation of Boiler." R. Clare. Liverpool Engineering Soc., The Temple, 24 Dale St, 7 p.m.

Purchasing Officers' Assoc. (Birmingham). "Electronics and Automation." Grand Hotel, 7 p.m.

Incorp. Plant Engrs. (Blackburn). "Fabrication in a Modern Welding Shop." R. M. Watts. Golden Lion Hotel, 7.30 p.m.

I.E.S. (Manchester). "Fading and Related Effects associated with Radiation from Light Sources." B. S. Cooper. Elect. Offices, Town Hall Extension, 6 p.m.

FRIDAY, 16 DEC.

I.E.E. (Irish). 1954-55 Faraday Lecture: "Courier to Carrier in Communications." T. B. D. Terroni. Mansion Hse, Dublin, 8 p.m.

I.E.E. (N. Staffs). "Automatic Circuit Reclosers." G. F. Peirson, A. H. Pollard and N. Care. Elect. Offices, Stoke-on-Trent, 7 p.m.

E.P.E.A. (London). "Economics of Meter Maintenance." L. B. S. Golds. Caxton Hall, Westminster, 6.30 p.m.

I.E.S. (Birmingham). "Lighting Problems in Laboratories." P. S. Crowther and W. H. Pritchard. Regent Hse, St. Phillip's Place, Colmore Row, 6 p.m.

SATURDAY, 17 DEC.

A.S.E.E. (Oxford and Reading). "Motor Fault Tracing." W. G. Wrigley. Y.M.C.A., George St, Oxford, 6.30 p.m.

TUESDAY, 20 DEC.

I.E.E. (S.E. Scotland). "High-Speed Electronic Analogue Computing Techniques." D. M. MacKay. Carlton Hotel, North Bridge, Edinburgh, 7 p.m.

Incorp. Plant Engrs. (S. Wales). "Steam and Utilisation."—Film Show. Engineers Inst., Park Place, Cardiff, 7.15 p.m.

I.E.S. (Liverpool) and A.S.E.E. "Lighting in Rayon Industry." G. E. Shepherd. Engineering Soc., The Temple, 24 Dale St, 6 p.m.

A.S.E.E. (London). "Heat Pump with Reference to Domestic Installations." G. Peter Watson. 2 Savoy Hill, W.C.2, 6.30 p.m.

A.S.E.E. (Portsmouth). "Electricity in the Aircraft Industry." W. A. Pile. Air Balloon, 598 Commercial Rd, Mile End, 7.30 p.m.

FRIDAY, 23 DEC.

Leicester Electrical Soc. Christmas Party at the Trocadero.

TUESDAY, 27 DEC.

Royal Instn. First of annual Christmas Lectures: "Big Molecules," by Prof H. W. Melville. 21 Albemarle St, W.1, 3 p.m.

THURSDAY, 29 DEC.

I.E.E. (London). Annual Christmas Lecture for School Children: "Electric Traction." R. Brooks. Savoy Place, W.C.2, 3 p.m. (repeated on 30 Dec.).

Purchasing Officers' Assoc. (West). "Atomic Energy and Industry." M. F. Jones. Royal Hotel, Bristol, 7.30 p.m.

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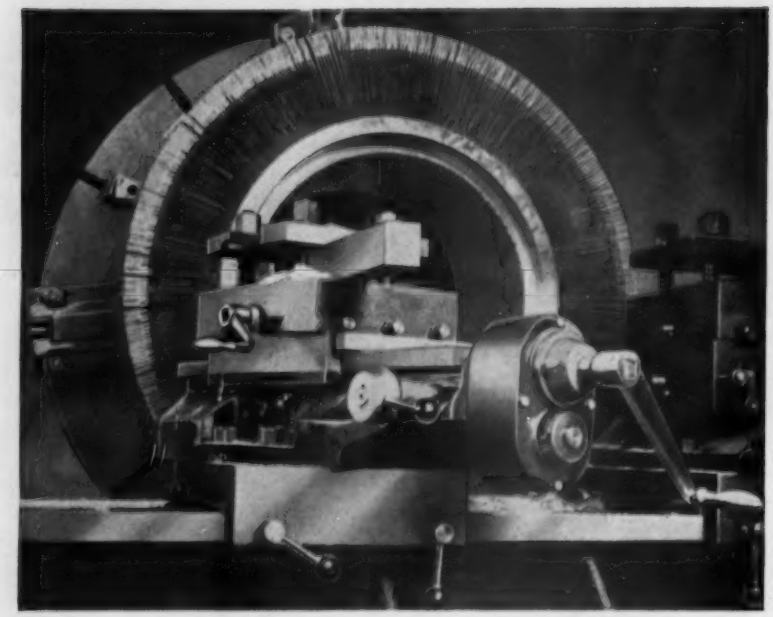

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CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

FEDERAL HYDRO-ELECTRIC BOARD OF RHODESIA AND NYASALAND

KARIBA HYDRO-ELECTRIC SCHEME

THE Federal Hydro-Electric Board propose to call for Tenders for the supply, delivery and erection of:

(*a*) 330 kV CABLE AND ANCILLARY CABLES

required for the connection between Kariba Power Station and its associated switching station. Three 3-phase sets of 330 kV cables are required, each set being capable of connecting a 240 MVA, 330 kV transformer to 330 kV switchgear. The route length of each 3-phase set of 330 kV cables will be approximately 2,000 ft, which includes a vertical length of approximately 600 ft. The 330 kV cable shall be capable of withstanding an impulse level of 1,350 kV at an altitude of 1,200 ft.

The ancillary cables consist of 11 kV and multicore cabling along the same route as the 330 kV cables.

(*b*) SHUNT COMPENSATING REACTORS.

The work will be divided into two sections the first covering two reactors for Kariba Power Station and 10 reactors for Substations at Kitwe, Salisbury, Norton, Umniati and Bulawayo respectively. Tenderers will be at liberty to Tender for either section separately or the two together.

The reactors for the Power Station shall be of the 3-phase water-cooled type connected in star to the generator terminals. Their capacity shall each be 40 MVA at 18 kV.

The reactors for the substations shall be of the 3-phase water-cooled type connected in star to the generator terminals. Their capacity shall each be 40 MVA at 18 kV.

The reactors for the substations shall be of the 3-phase type with O.N. cooling. The capacity of each reactor shall be 20 MVA and they will be connected in star to the 11 kV tertiary winding of power transformers being provided under another Contract.

(*c*) MAIN AND AUXILIARY SWITCHGEAR.

for Kariba Power Station, comprising:

5—1,500 MVA, 18 kV, 4,000 A indoor air-blast switchgear and 4,000 A isolators for the generators.

2—2,000 MVA, 18 kV, 1,600 A indoor air-blast switchgear and 1,600 A isolators for the shunt reactors.

Auxiliary 11 kV, 400 A, 100 MVA oil-filled switchgear.

Auxiliary 380 V, 1,600 A, 15 MVA air-break switchgear.

Auxiliary switch-fuse gear.

Contractors who may be interested in tendering for any of the equipment set out above should submit full details of their qualifications and experience by 14 Jan. after which Tender Documents and Drawings will be issued to those Contracting Organisations who satisfy the requirements of the Board.

Details of qualifications and experience should be sent in duplicate to the Secretary, Federal Hydro-Electric Board, P.O. Box 630,

continued in next column

continued from previous column

Salisbury, Southern Rhodesia, with a copy to the Mechanical and Electrical Consulting Engineers, Messrs Merz and McLellan, Carliol House, Newcastle upon Tyne 1, England. (W 232)

BOROUGH OF STOCKTON-ON-TEES

RE-LIGHTING OF TRUNK ROAD A.19

THE Council invite separate tenders for the supply of:

(*a*) 101 No. Prestressed Concrete Group A Lighting Columns.

(*b*) 101 No. 140 W S.V.D. Lamps, Lanterns and Ancillary equipment.

Forms of Tender, Conditions of Contract and Specifications may be obtained from the Borough Engineer, Victoria Buildings, High St, Stockton-on-Tees, on payment of £4. 4s. (£2. 2s. for each individual tender) which sum will be returned after receipt of a bona fide tender.

Tenders in plain sealed envelopes not bearing any name or mark indicating the sender endorsed "Re-lighting of Trunk Road A.19—Tender A and/or B" must reach the undersigned not later than 10 a.m. on Wednesday, 4 Jan., 1956.

JOHN B. HAWORTH,
Barclays Bank Chambers, Town Clerk.
Stockton-on-Tees. (W 258)

METROPOLITAN BOROUGH OF WANDSWORTH

SUPPLY OF INSULATED CABLE

TENDERS are invited for the supply and delivery of Polythene Insulated Armoured Cable.

Tender documents, obtainable from the Borough Engineer at the undermentioned address, must be returned by noon on Wednesday, 28 Dec., 1955.

R. H. JERMAN,
Municipal Buildings, Town Clerk.
Wandsworth, S.W.18. (W 209)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

CENTRAL ELECTRICITY AUTHORITY
Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER is required at Ocker Hill Generating Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade F9, £675/£720 per annum. The station will shortly be reclassified to Class G.

A sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 163MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 31 Dec., 1955. (W 253)

CENTRAL ELECTRICITY AUTHORITY
Midlands Division

APPLICATIONS are invited for positions as STATION SHIFT CONTROL ENGINEERS in the following Power Stations. N.J.B. service conditions, superannuable appointments, salaries within Schedule A of the Agreement.

(*a*) Nechells B Power Station, Grade J10, £755/£800 per annum (Vacancy No. 167MD).

(*b*) Walsall Power Station, Grade H10, £715/£760 per annum. (Vacancy No. 168MD).

(*c*) Hams Hall "A" Power Station, Grade J10, £755/£800 per annum. (Vacancy No. 169MD).

(*d*) Nechells "A" Power Station, Grade F10, £635/£680 per annum, (Vacancy No. 170MD).

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications will be an advantage.

Apply quoting the vacancy number on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 31 Dec., 1955. (W 254)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT (TECHNICAL) required in the Board's Southport District. Salary within the range £555/£600 per annum (N.J.B. E.11).

Applicants should have received a sound electrical training, and possess suitable technical qualifications. Appointment subject to medical examination. Pension Scheme.

Duties include estimating for contracting work, and advising consumers on electricity supply matters and appliances.

Standard application forms obtainable from the Manager, No. 1 Sub-Area, 24 Hatton Garden, Liverpool 3. Closing date: 28 Dec., 1955. (W 210)

YORKSHIRE ELECTRICITY BOARD
No. 7 (Grimsby) Sub-Area

GAINSBOROUGH DISTRICT
DISTRICT COMMERCIAL ENGINEER

CANDIDATES must be capable of conducting the development of a District, supervising a District Commercial Organisation, and have sound experience covering:

(*a*) Consumer service.

(*b*) Industrial and Commercial Development of Electricity Supply.

(*c*) Control of Service Centre Sales and Staff.

(*d*) Control of Electrical Contracting and Maintenance Department and Staff.

(*e*) Administration and operation of hire and hire purchase schemes.

(*f*) Consumers Records.

Appropriate technical qualification would be an advantage.

Salary—N.J.B. Class D, Grade 4, £790/£20/£850 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 30 Dec., 1955.

No. 3 (Sheffield) Sub-Area

SHEFFIELD SOUTH AND SHEFFIELD NORTH DISTRICTS
GENERAL ASSISTANT DISTRICT ENGINEERS

Applicants must hold at least the Higher National Certificate in Electrical Engineering and should have had experience in construction and maintenance work on 11 kV and L.V. overhead and underground mains in a district containing a heavy industrial and densely developed residential area surrounded by a rural area.

Salary—Sheffield South—N.J.B. Class H, Grade 15 £515/£15/£560 per annum. Sheffield North—N.J.B. Class K, Grade 17, £515/£15/£560 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St, Sheffield, not later than 30 Dec., 1955. (W 242)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Board Headquarters

PRINCIPAL ASSISTANT (FINANCIAL ACCOUNTS SECTION)

The post is one of considerable responsibility and calls for large-scale administrative and accountancy experience—preferably with a public authority. The duties will include work in connection with the preparation of the Area Board's final accounts together with all associated matters, including taxation and the organisation of accounting within the area. Preference will be given to qualified Accountants. Salary and conditions of service will be in accordance with the National Joint Council, Grade 9, £1,080/£1,200 per annum.

Applications, giving full particulars of qualifications, age, experience and present salary should be forwarded within fourteen days, to the Secretary (Ref.: FWC), Midlands Electricity Board, Mucklow Hill, Halesowen, Nr. Birmingham.

Central Gloucestershire Sub-Area

GENERAL ASSISTANT ENGINEER (METER DEPARTMENT) (CHELTENHAM DISTRICT)

Duties will include laboratory work, substandard instrument calibration, the testing of polyphase metering equipment both in the Test Room and on consumers' premises, and the carrying out of special tests on other apparatus including switchgear and relays. Technical qualifications desirable. Salary £475/£520 per annum (N.J.B. Grade H.16).

Apply, by letter, to Mr S. Raybould, Sub-Area Manager, Midlands Electricity Board, 126 London Rd, Gloucester.

A. STEPHENS,
Secretary.
(W 235)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are subject to medical examination, Pension Scheme.

No. 3 Sub-Area

(1) SECOND ASSISTANT ENGINEER (TECHNICAL)

in the No. 3 Sub-Area Headquarters at Chester. Salary £900/£975 per annum (N.J.B. J.7).

Applicants should have had experience on modern protective systems, underground cable fault location, and the testing and commissioning of switchgear, transformers and associated equipment, preferably up to 33 kV, and be in possession of appropriate technical qualifications.

Application forms obtainable from the Manager, No. 3 Sub-Area, Electricity House, Newgate St, Chester.

No. 4 Sub-Area

(2) THIRD ASSISTANT ENGINEER (OPERATION AND MAINTENANCE)

in the No. 4 Sub-Area Headquarters, Electricity House, Rhostyllen, near Wrexham. Salary £790/£850 per annum (N.J.B. K.10).

Duties include plant and network loading and operational work associated with the Sub-Area H.V. system, together with radio and land line communication equipments. Suitable technical qualifications desirable.

(3) ASSISTANT SECTION ENGINEER

in the Conway Valley District, based on Bettws-y-Coed. Salary £635/£680 per annum (N.J.B. E.9).

Duties include the erection and maintenance of H.V. and M.V. overhead and underground systems.

(4) COMMERCIAL ASSISTANT (TECHNICAL)

to be based on Wrexham. Salary £595/£640 per annum (N.J.B. F.11).

Applicants should have had an engineering training and experience in dealing with installation work, consumers' supply enquiries and general commercial duties.

For Posts (2), (3) and (4), application forms are obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham.

Closing date: 28 Dec., 1955. (W 240)

AIR MINISTRY AND MINISTRY OF SUPPLY

require ELECTRONIC ENGINEERS and TECHNICIANS for Research and Development, Production and Inspection Branches in London and Provinces.

Ambitious men can get first-class experience which will enhance their career prospects. Salaries range up to £1,095 per annum, according to age, qualifications and experience. The normal duties attaching to most of these appointments are designed to meet the requirements of professional responsibility for corporate membership of the professional institutions, and applications are specially invited for these posts from candidates who possess the educational qualifications and practical training required for corporate membership of the institutions.

Applicants should have a sound knowledge of theory and practice of electronic or light electro-mechanical engineering. Experience in either design, development, maintenance, inspection, production or operation of electronic, electro-mechanical, radio or radar installations and equipment or in design of jigs and tools would be an advantage. All applicants should have served a recognised engineering apprenticeship or have had equivalent training in an appropriate trade. For higher posts applicants should either be Corporate Members of one of the Institutions of Civil, Mechanical or Electrical Engineers or have exempting qualifications. Those lacking higher academic qualifications should have had several years' post-training experience in their trade and preferably have at least H.N.C. or equivalent qualifications.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26 King St, London, S.W.1, quoting D.558/5A/HP.
(W 213)

CENTRAL ELECTRICITY AUTHORITY

South Wales Division

APPLICATIONS are invited for superannuable N.J.B. appointment of ASSISTANT ENGINEER (COMBUSTION AND EFFICIENCY), Cardiff Power Station.

Salary F.7 £755/£800 per annum.

Applicants should preferably have obtained H.N.C. and served a regular apprenticeship. Power station experience and knowledge of Automatic Combustion Control Equipment desirable.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Road, Gabalfa, Cardiff, to be returned by 31 Dec., 1955.

(W 243)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEERS (PLANNING) (TWO VACANCIES)

ALDERSHOT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 10 (£635/£680 per annum). N.J.B. Conditions of Service.

The successful candidates will be required to assist the Planning Engineer in the preparation of schemes and estimates for extensions and/or reinforcements to overhead and underground H.V. and L.V. networks. Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground systems, substation plant and distribution equipment. The possession of suitable technical qualifications will be an advantage and the appointment will involve standby duties.

The successful candidates for the above appointments will be required to contribute to the C.E.A. and Area Boards' Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 30 Dec., 1955. (W 238)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

CENTRAL ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (*a*) and Corporate Membership for post (*b*) an advantage.

(*a*) ASSISTANT ENGINEER (EFFICIENCY AND TESTING) ACTON LANE POWER STATION

Vacancy No. 55/1021

Experience on plant testing and heat balance calculations desirable. Salary—Class J, Grade 10=£792. 15s. per annum.

(*a*) SECOND ASSISTANT ENGINEER (SHIFT) BARKING A/B POWER STATION

Vacancy No. 55/1022

Applicants should have a sound technical education with experience in the operation of E.H.T. switchgear, station auxiliaries and the control of large Turbo-alternators would be an advantage. Duties of successful applicant will be those of Second Assistant to Station Shift Control Engineer in charge of Control Room. Salary—Class L, Grade 14 =£708. 15s. per annum.

(*a*) ASSISTANT SHIFT CHARGE ENGINEER FULHAM POWER STATION

Vacancy No. 55/1023

Applicants should have received sound technical training and be experienced in operation of a large modern Power Station. Salary—Class K, Grade 9=£882 per annum.

(*b*) DEPUTY STATION SUPERINTENDENT POPLAR POWER STATIONS

Vacancy No. 55/1024

Experience in administrative duties, programming of maintenance work and efficient operation of plant. Salary—Class E, Grade 3=£945 per annum.

(*a*) SHIFT CHARGE ENGINEER STEPNEY POWER STATION

Vacancy No. 55/1025

Sound electrical and mechanical training necessary with experience in efficient operation of Power Station. Character and ability to deal with Staff problems is important. Salary—Class F, Grade 7= £792. 15s. per annum.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (W 219)

AIR MINISTRY

require STATION ENGINEERS (G.D.) and STATION ENGINEERS (Mech.) at Royal Air Force and Ministry of Transport and Civil Aviation Stations. Qualifications required (*a*) Ordinary National Certificate in Electrical or Mechanical Engineering or show that an equivalent standard of technical education has been reached. (*b*) recognised apprenticeship in electrical or mechanical engineering with firm or establishment of good repute. (*c*) three years' employment in electrical or mechanical engineering preferably on operation and maintenance of mine, factory or workshop plant and services. Preference given to applicants who have had supervisory duties subsequent to (*b*) and (*c*). Work will consist of installation, operation and maintenance of high and medium voltage electrical distribution systems, electrical installations, generating plant, steam and hot water heating systems and miscellaneous works plant tools and equipment. Commencing salary according to age, qualifications and experience on range from £565/£812. Lodging allowance payable in certain circumstances. Liability for tours of duty overseas for which special allowance payable in addition to higher salary. Appointments non-pensionable. Only natural-born British subjects. Write, giving age, full details of qualifications and experience to AB.1255, London Appointments Officer, Ministry of Labour and National Service, 1-6 Tavistock Sq, W.C.1. No original Testimonials should be sent. Only candidates selected for interview will be advised. (W 212)

SOUTH EASTERN ELECTRICITY BOARD

SENIOR SALES REPRESENTATIVE—CROYDON DISTRICT

SALARY £525 x £20—£585 per annum plus London Weighting under N.J.C. Grade 2. The successful applicant should be able to advise on supply matters, tariffs, apparatus and sales to consumers with domestic or small commercial or industrial installations.

SHOWROOM ASSISTANT (MALE)—CROYDON DISTRICT

Annual salary £170/£410 or £190/£495 plus London Weighting, according to age, educational qualifications and experience. Superannuable. A knowledge of electrical apparatus and experience in dealing with consumers' enquiries will be an advantage. The person appointed must be prepared to work in any of the Croydon district showrooms.

Applications for these two Croydon district appointments, naming two referees, on forms from H. Lowe, M.I.E.E., District Manager, SEEBoard, Electric House, Wellesley Rd, Croydon, by 31 Dec., 1955.

ASSISTANTS (ESTATES AND WAYLEAVES)—SURREY SUB-AREA HEADQUARTERS, DORKING

Salary—Post 1 £585/£645 per annum under N.J.C. Grade 3.
Post 2 £525/£585 per annum under N.J.C. Grade 2.

Both posts superannuable. Duties will principally include negotiations for the acquisition of substation sites throughout the sub-area.

Applicants for Post 1 should have responsible experience in the acquisition of property by purchase or lease; they should have a knowledge of land values and be familiar with relevant statutory requirements.

Applicants for Post 2 should preferably have some experience as above but with lesser degree of responsibility.

Applications, naming two referees, on forms from C. W. Hughes, B.SC., M.I.E.E., Surrey Manager, SEEBoard, Rough Rew, Horsham Rd, Dorking, by 31 Dec., 1955.

GENERAL ASSISTANT DISTRICT ENGINEER—TUNBRIDGE WELLS DISTRICT

Salary £515 x £15—£560 per annum under N.J.B. Class F, Grade 13. Superannuable. Applicants should preferably hold the National Certificate in Electrical Engineering or its equivalent and have had some training or experience on general distribution work.

ASSISTANT DISTRICT ENGINEER—TUNBRIDGE WELLS DISTRICT

Salary £675 x £15—£720 per annum under N.J.B. Class F, Grade 9. Superannuable. Applicants should preferably hold the Higher National Certificate in Electrical Engineering or its equivalent, and have had practical experience in underground and overhead distribution work on systems up to 11 kV. Successful applicant will be required to undertake standby duties.

CARTOGRAPHIC DRAUGHTSMAN—TUNBRIDGE WELLS DISTRICT

Salary within the range £525 x £20—£585 per annum under N.J.C. Grade 2. Applicants should have experience in the preparation of mains records, development plans and substation layout. Knowledge of Overhead Line Survey work an advantage.

Applications for these three Tunbridge Wells district appointments, naming two referees, to T. W. Dann, M.ENG., M.I.E.E., District Manager, SEEBoard, Town Hall, Tunbridge Wells, by 31 Dec., 1955.

SENIOR SALES REPRESENTATIVE—PURLEY DISTRICT

Salary £525 x £20—£585 per annum under N.J.C. Grade 2, plus London Weighting. Superannuable. The person appointed will be required to give advice on supply matters, tariffs, apparatus and sales to consumers with domestic or small commercial or industrial installations. A sound knowledge of wiring an advantage.

DEMONSTRATOR—PURLEY DISTRICT

Salary £425/£525 under N.J.C. Grade 1, plus London Weighting. Superannuable. Duties will include public demonstrations, advice to consumers on appliances, etc. and assisting in showrooms. Possession of the

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E.A.W. Certificate or equivalent domestic science qualification is desirable.

Applications for these two Purley district appointments, naming two referees, on forms from J. McAlister, B.SC., A.M.I.E.E., District Manager, SEEBoard, Electric House, High St, Purley, by 31 Dec., 1955.

A. L. BURNELL,
Secretary.
(W 233)

CENTRAL ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointments in the Technical (Electrical) Department:

(*a*) FOURTH ASSISTANT ENGINEER (TELECOMMUNICATIONS) AT DIVISIONAL HEADQUARTERS

Salary Class AX/DX, Grade 5, £675 x £25—£800/£860 per annum plus London Weighing.

(*b*) FOURTH ASSISTANT ENGINEER (TELECOMMUNICATIONS) AT BEDFORD

Salary Class AX/DX, Grade 5, £675 x £25—£800/£860 per annum.

Applicants should possess professional qualifications equivalent to the Higher National Certificate in Electrical Engineering. Experience in the installation and maintenance of all types of telecommunication equipment used by the Authority is desirable.

(*c*) FOURTH ASSISTANT ENGINEER (TELECOMMUNICATIONS-CONSTRUCTION) AT DIVISIONAL HEADQUARTERS

Salary Class AX/DX, Grade 5, £675 x £25—£800/£860 per annum plus London Weighing.

Applicants should possess professional qualifications equivalent to the Higher National Certificate in Electrical Engineering. Experience in the installation of telecommunication equipment including the preparation of cable layouts is desirable. Ability to supervise staff is essential.

The successful applicants for positions (*a*) and (*c*) will be required to reside within a reasonable distance of Cockfosters, and for (*b*) within a reasonable distance of Bedford.

Applications, endorsed with the appointment sought, stating age, qualifications, experience and present position should be sent to the Controller, Central Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than 30 Dec., 1955.

W. N. C. CLINCH,
Controller.
(W 208)

AIR MINISTRY

require MECHANICAL and ELECTRICAL ENGINEERS in Works Department for design, operation and maintenance of mechanical and electrical services on R.A.F. stations at home and overseas and Civil Aviation stations. Appointments in two grades (*a*) Main Grade, salary scale £1,182/£1,527, (*b*) Assistant Grade £761/£1,182. Starting pay according to qualifications and experience. Salaries somewhat lower in provinces. Appointments non-pensionable but with long-term possibilities. Special allowance up to £1,500 a year, according to location, payable in addition to salary during overseas service. Candidates normally must be natural-born subjects of natural-born British parents and age 25 or over. Minimum qualifications and experience for both grades of posts: (i) (*a*) University degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or (*b*) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or (*c*) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience with at least 3 years' apprenticeship. (ii) Have been employed for minimum of three years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice. Application forms quoting reference D240/5A from M.L.N.S., Technical and Scientific Register (K), 26 King St, London, S.W.1.
(W 63)

LONDON ELECTRICITY BOARD

ENGINEERS (OPERATION AND MAINTENANCE)

APPLICATIONS are invited for the posts of Engineer (Operation and Maintenance) in the Finsbury/Shoreditch and City Districts of the Northern Sub-Area.

Applicants should have had a sound technical education and should have had practical experience in all branches of engineering work associated with the organisation of a District distribution department, particularly in regard to mains and substation work on both A.C. and D.C. systems.

The posts are graded under Schedule A of the National Joint Board Agreement as Class F, Grade 9—£708. 15s. per annum rising to £756 per annum, inclusive of London Allowance.

GENERAL ASSISTANT ENGINEER

Applications are invited for the above position in the Finsbury/Shoreditch District of the Northern Sub-Area.

Applicants should have had a sound technical education up to at least National Certificate standard, with practical experience in general mains work, including installation and maintenance of distribution systems, with the preparation and keeping of associated records.

Pending determination as to the grading and salary applicable to the post within the National Joint Board Agreement, the provisional minimum salary will be £500 per annum, inclusive of London Allowance.

Applications forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned completed by 31 Dec., 1955. Please state vacancy preferred and quote ref.: PER/V/2087/8/T. (W 194)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the positions of SENIOR ASSISTANT ENGINEER (Electrical or Mechanical) and SECOND ASSISTANT ENGINEER (Electrical or Mechanical) in the Generation/Construction Section of the Chief Engineer's Department.

Applicants should preferably hold a degree in Electrical or Mechanical Engineering, and be Corporate Members of the Institution of Electrical Engineers or the Institution of Mechanical Engineers, or have equivalent qualifications.

They should have had experience in (*a*) the design and installation of switchgear, transformers and cables up to 33 kV, and other electrical equipment associated with modern power stations, or (*b*) the design and construction of turbo-generators, boilers, coal and ash handling plant, high pressure steam and water piping and other ancillary work.

Experience in the preparation of specifications and estimates and analysis of tenders would be an advantage.

Salary—National Joint Board Agreement, Schedule C, Class AX/DX.

Senior Assistant Engineer—Grade 1—£1,100/£1,315 per annum.

Second Assistant Engineer—Grade 2—£950/£1,165 per annum.

The positions are superannuable. Applications should be made on the standard application form, which may be obtained from the undersigned and returned not later than 30 Dec., 1955.

J. MEEK,
Secretary.

P.O. Box 173,
351 Sauchiehall St,
Glasgow, C.2.
7 Dec., 1955. (W 229)

SOUTH OF SCOTLAND ELECTRICITY BOARD

SECOND ASSISTANT STATION CHEMIST BRAEHEAD POWER STATION

SOUTH of Scotland Electricity Board requires SECOND ASSISTANT STATION CHEMIST at Braehead Power Station, Renfrew. Qualifications at least Higher National Certificate in Chemistry or equivalent. Post Superannuable. Salary £675/£720 per annum.

Applications in writing to the Secretary, South of Scotland Electricity Board, 168 Broomhill Drive, Glasgow W.1, before 28 Dec., 1955. (W 230)

CENTRAL ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

ASSISTANT MECHANICAL MAINTENANCE ENGINEER
NORTH WILFORD POWER STATION, NOTTINGHAM
Vacancy No. 223/55/ET

Applicants should have had a fundamental training in Mechanical Engineering, including Workshops and should preferably have experience in the maintenance of Mechanical Plant as installed in a modern Power Station.

Preference will be given to candidates who are Corporate Members of the appropriate professional Institution or hold qualifications leading to such membership.

Salary will be in accordance with Class K, Grade 8 (£900 x £25—£975 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

ASSISTANT ELECTRICAL MAINTENANCE ENGINEER
COVENTRY POWER STATION
Vacancy No. 233/55/ET

Applicants should have received a thorough technical and practical training, with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who hold a recognised qualification.

Salary will be in accordance with Class G, Grade 8 (£755 x £15—£800 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

SHIFT CONTROL ENGINEER
DRAKELOW POWER STATION
Vacancy No. 231/55/ET

Applicants should be in possession of the Higher National Certificate in Electrical and/or Mechanical Engineering, and have had experience in the control and load despatching of large capacity steam generating plant connected to the National Grid System.

Salary will be in accordance with Class J, Grade 10 (£755 x £15—£800 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

ASSISTANT SHIFT CHARGE ENGINEER
BURTON-UPON-TRENT POWER STATION
Vacancy No. 225/55/ET

Applicants should have had experience in the operation and maintenance of modern steam plant and also some electrical experience.

Salary will be in accordance with Class E, Grade 9 (£635 x £15—£680 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

PLANT CONTROL ENGINEERS
CASTLE DONINGTON POWER STATION
Vacancy No. 224/55/ET

Experience desirable in control of Boilers and Turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National Standard desirable.

Salary will be in accordance with Class L, Grade 10 (£840 x £20—£900 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

ASSISTANT ENGINEER (INSTRUMENTS)
LEICESTER POWER STATION
Vacancy No. 232/55/ET

Applicants should have the Higher National Certificate or equivalent together with sound practical experience in the maintenance of instruments in a large P.F.-fired generating station.

Salary will be in accordance with Class H, Grade 10 (£715 x £15—£760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

FOURTH ASSISTANT ENGINEER
STAYTHORPE POWER STATION
Vacancy No. 227/55/ET

The Section contains extensive 275 kV and 132 kV equipment and the candidates

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must have had wide experience in the maintenance and operation of 132 kV lines and substations in a Transmission Section.

Preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary will be in accordance with Class AX/DX, Grade 6 (£600/£785 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

SHIFT CHARGE ENGINEER
AVON POWER STATION, WARWICK
Vacancy No. 203/55/ET

Applicants should be suitably qualified and have had experience in the operation of modern boiler and turbine plant.

Salary will be in accordance with Class E, Grade 7 (£715 x £15—£760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

SHIFT CHARGE ENGINEER
BURTON-UPON-TRENT POWER STATION
Vacancy No. 219 55/ET

A sound technical training and practical experience in the control and operation of steam generating plant and main switchgear are required. Appropriate qualifications an advantage.

Salary will be in accordance with Class E, Grade 7 (£715/£760 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 22 Dec., 1955.

STATION CONTROL ENGINEER
CASTLE DONINGTON POWER STATION
Vacancy No. 235/55/ET

Applications invited from suitably-qualified Engineers who have had experience in control and operation of large Turbo Alternators.

Salary will be in accordance with Class L, Grade 10 (£840 x £20—£900 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 5 Jan., 1956.

These appointments will be pensionable within the terms and provisions of the Central Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.

9 Dec., 1955. (W 241)

CENTRAL ELECTRICITY AUTHORITY
Nuclear Power Branch

APPLICATIONS are invited for the following appointments on the staff of the Chief Engineer at Bankside House, London, S.E.1, for work on the generation of electricity from nuclear energy:

SENIOR ASSISTANT ENGINEER (MECHANICAL). Candidates should have a sound fundamental training in Mechanical Engineering and preferably possess a degree and/or be Corporate Members of the Institution of Mechanical Engineers, together with experience in the design and construction of modern power stations.

SENIOR ASSISTANT ENGINEER (LAYOUT AND OUTLINE DESIGN). Candidates should have a sound fundamental engineering training and preferably possess a degree and/or be Corporate Members of one of the senior institutions, together with experience in the design and construction of modern power stations, with emphasis on civil engineering and building work.

Salaries for both the appointments will be within N.J.B. Grade 1, Schedule C, i.e. £1,150/£1,500 inclusive.

Applications, stating age, qualifications, experience, present position and salary and specifying vacancy applied for to D. Moffat, Director of Establishments, Winsley St, London, W.1, not later than 6 Jan., 1956. Quote Ref. AE/716. (W 207)

THE NORTH WESTERN ELECTRICITY BOARD

FOURTH ASSISTANT DISTRICT ENGINEER, NORTH DISTRICT, SALFORD

THE duties will include assisting in the supervision of the erection and maintenance of substation switchgear, laying and jointing of cables, keeping of substation records, etc.

Applicants should hold the H.N.C. in Electrical Engineering and should have had practical experience in substation work, operation cable laying and jointing, etc. Corporate membership of the Institution of Electrical Engineers will be an advantage.

Salary Scale: £595 x £15—£640 per annum. Grade F.11. N.J.B. Conditions.

ASSISTANT DISTRICT MAINS RECORDER, SOUTH WEST DISTRICT, ALTRINGHAM

Duties will include mains surveying, plotting, sketching and revision of ordnance sheets, etc.

Salary Scale: £190/£495 per annum according to age. N.J.C. Conditions.

Applications for the above posts to Sub-Area Secretary, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 24 Dec., 1955.

THIRD ASSISTANT ENGINEER (OPERATION AND MAINTENANCE) SUB-AREA ENGINEER'S DEPARTMENT, CARLISLE

Applicants should possess the H.N.C. in Electrical Engineering or its equivalent, and have working experience on large transformers, switchgear, and overhead lines operating at voltages up to 33 kV. Experience on steel tower lines and supervision of labour would be an advantage. Duties will include the maintenance of records and the preparation of reports in connection with the work.

Salary Scale: £755 x £15—£800 per annum, Grade J.10, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 24 Dec., 1955. (W 218)

LONDON ELECTRICITY BOARD

STRUCTURAL ASSISTANTS AND STRUCTURAL DRAUGHTSMEN

APPLICATIONS are invited for the above positions in the Construction Branch of the Chief Engineer's Department in Central London.

Applicants for the positions of Structural Assistants in the Civil Engineer's Section should be experienced in the design and detailing of reinforced concrete, and/or steel framed superstructures and foundations.

Applicants for the positions of Structural Draughtsmen should have a knowledge of building construction requirements and/or some experience in detailing reinforced concrete or steel structures.

The posts are graded under Schedule D, National Joint Board agreement as Grade 5—£672/£777, and Grade 6—£535. 10s./£661. 10s. per annum respectively, inclusive of London Allowance. Commencing salaries will be dependent on qualifications and experience.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned completed by 27 Dec., 1955. Please enclose addressed envelope and quote ref.: V/2003/T. (W 195)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

Vacancy No. 135/55

APPLICATIONS invited for superannuable N.J.B. appointment of SENIOR ASSISTANT ENGINEER (Construction) in the Transmission Department, Divisional Headquarters.

Salary—AX/DX 1, £1,100/£1,315 per annum.

Applicants should be qualified engineers and have had considerable experience of the design, layout and construction of high voltage substations and overhead lines.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 31 Dec., 1955. (W 215)

CENTRAL ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following posts:

THIRD ASSISTANT ENGINEER (SUBSTATIONS CONSTRUCTION) TRANSMISSION DEPARTMENT, DIVISIONAL HEADQUARTERS
S/13.768

Applicants should have experience in the design, layout and installation of substations employing switchgear preferably up to a working voltage of 275 kV and transformers up to 60 MVA capacity.

A knowledge of overhead line and underground cable work and experience of the supervision of site erection is necessary.

Applicants should possess qualifications leading to corporate membership of a senior engineering institution, or hold equivalent qualifications.

Salary N.J.B. AX/CS, Grade 4, £750/£925.

FOURTH ASSISTANT ENGINEER, TECHNICAL DEPARTMENT, DIVISIONAL HEADQUARTERS
S/13.769

Applicants should have had suitable experience of technical work in relation to system development, including ability to carry out the calculations involved in studies on inter-connected power systems and preliminary investigation of schemes for system development.

Candidates should preferably either possess or be studying for qualifications leading to corporate membership of an appropriate professional institution.

Salary N.J.B. AX/CX, Grade 6, £600/£765.

ASSISTANT ENGINEER (GRADE 9) AND SHIFT CONTROL ENGINEER, SOUTHAMPTON GENERATING STATION
S/13.770
S/13.771

Applicants should have had appropriate experience in a modern generating station, and manufacturing works experience will be an advantage. The Grade 9 Engineer may be required to work in either the Boiler House or the Turbine Room, or on Efficiency work.

Applicants should possess a Higher National Certificate or its equivalent and preferably possess or be studying for qualifications leading to corporate membership of an appropriate professional institution.

Salaries:

Assistant Engineer (Grade 9) N.J.B. F/9, £675 x £15—£720.

Shift Control Engineer, N.J.B. F/10, £635 x £15—£680.

SECOND ASSISTANT STATION CHEMIST, PORTSMOUTH GENERATING STATION
S/13.772

Applicants should have had practical experience of fuel, water and oil testing appropriate to a modern generating station, and a knowledge of boiler chemistry for high steam pressures and temperatures will be an advantage. Applicants should preferably possess H.N.C. in chemistry or hold equivalent qualifications.

Salary N.J.B. Grade G.11, £635/£680.

ENGINEERING DRAUGHTSMEN (ELECTRICAL), CONSTRUCTION DEPARTMENT
S/13.773

Applicants should have had experience of the layout of switchgear, cables and lighting in connection with power station construction. Experience in schematic diagrams will be an advantage. Candidates should have had a good technical education in electrical engineering.

Salary:

N.J.B. D5, £640 x £20—£740 and N.J.B. D6, £510 x £20—£630.

ENGINEERING DRAUGHTSMEN (MECHANICAL), CONSTRUCTION DEPARTMENT
S/13.774

Applicants should have had experience of work concerning turbines and auxiliaries, boilers and auxiliaries, coal and ash handling plant and pipework. Candidate should have had a sound technical education in mechanical engineering.

Salary:

N.J.B. Grade D5, £640 x £20—£740 and N.J.B. Grade D6, £510 x £20—£630.

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GENERAL ASSISTANT ENGINEERS
S/13.775

Applicants should have served an apprenticeship or had practical training suitable to the industry. They should possess a sound general and technical education and preference will be given to those possessing a Higher National Certificate (or those nearing completion of H.N.C. courses). Opportunities are available for general assistant engineers to complete their studies and gain wide experience with good prospects of promotion.

The duties of those appointed will vary, but will include, as a general rule, the operation and control, under supervision, of generating plant.

Vacancies also exist for those who wish to specialise in maintenance of electrical and mechanical generating plant, transmission lines, substations and cables, or generating station construction work.

Salary N.J.B. within scales £475/£640.

Special application forms for each post obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 3 Jan., 1956. Please quote reference E.T. (W 234)

EAST ANGLIA REGIONAL HOSPITAL BOARD

DEPARTMENT of the Regional Architect (Guy Addis, A.R.I.B.A., A.A.DIPL.) for planning of a scheme for the major development of a General Hospital which the Board is about to undertake.

(1) ASSISTANT ENGINEER (Mechanical) —Candidates to be experienced in design and installation of heating, ventilating, steam boiler plant and services, etc., and should be A.M.I.H.V.E., or Graduate Members of I.H.V.E., or equivalent. Salary £640/£930 per annum.

(2) ASSISTANT ENGINEER (Electrical) —Candidates to be experienced in design and installation of electrical engineering services and should be A.M.I.E.E., or Graduate Members of I.E.E., or equivalent. Salary £640/£930 per annum.

(3) ENGINEERING ASSISTANTS — Candidates to be experienced in work described above and possess Ordinary National Certificate (Mechanical or Electrical). Salary £480 (at age 21 or over)—£670 per annum.

(4) DRAUGHTSMEN (Engineering) — Candidates to have had suitable training and experience. Salary £390 (at age 21 or over) —£580 per annum.

Additional increments within the scale based on experience and age may be granted in respect of posts (1) and (2). Commencing salary for post (3) may be fixed at point above minimum but will not exceed £560 per annum.

Applications indicating appropriate post and stating age, qualifications, experience and details of present position with names of three referees to Secretary of Board, 117 Chesterton Rd, Cambridge, by 23 Dec., 1955. (W 126)

CENTRAL ELECTRICITY AUTHORITY
South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments:

UPPER BOAT STATION
SHIFT CONTROL ENGINEER
Vacancy No. 136/55

Salary H10—£715 x £15—£760.

H.N.C. and experience in power station control room desirable.

CARMARTHEN BAY POWER STATION
SHIFT CHARGE ENGINEER
Vacancy No. 137/55

Salary K7—£975 x £25 to £1,050 per annum.

Applicants should have obtained H.N.C. and served a regular apprenticeship. Operating experience in modern power station essential.

Application forms for both appointments obtainable from Secretary, South Wales Division, Central Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, to be returned by 31 Dec., 1955. (W 231)

EASTERN ELECTRICITY BOARD
Norfolk Sub-Area

DEMONSTRATOR—GREAT YARMOUTH DISTRICT

CANDIDATES should have had domestic science training including electrical housecraft, should preferably hold the E.A.W. Certificate and be competent to plan and give cookery demonstrations, including lectures and advice to consumers on the use of domestic electrical appliances.

Salary—N.J.C. Grade 1 (£425/£525) although progress beyond £465 will be subject to a certificate that the person concerned is capable of undertaking all the duties of the grade.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Apply, by letter, within 14 days to the District Manager, Eastern Electricity Board, Regent Rd, Great Yarmouth, Norfolk. (W 236)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPOINTMENT OF SUB-AREA MANAGER

APPLICATIONS are invited for the appointment of Manager of the Board's No. 3 Sub-Area, with Headquarters at Chester. The Sub-Area includes both rural and urban supplies, and has a substantial industrial load.

Salary £2,300/£2,550 per annum in accordance with N.J.M. Agreement.

The successful candidate may be required to undergo a medical examination, and will be required to subscribe to the Superannuation Scheme adopted by the Board.

Applications, on a form to be obtained from the undersigned, should be completed and returned so as to be received at this office not later than 30 Dec., 1955.

M. M. PARKER,
Secretary.
(W 239)

AIR MINISTRY
Works Designs Branch

requires in London and Provinces (with liability for overseas service (ELECTRICAL ENGINEERING DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution H.V. and M.V. Technical training to O.N.C. standard or equivalent an advantage. Salaries up to £725 per annum starting pay dependent on age, qualifications and experience. Paid overtime. Long term possibilities with promotion and pensionable prospects. Four weeks' leave a year. Natural born British subjects. Write stating age, qualifications, employment details, including type of work done, to any Employment Exchange, quoting Order No. Borough 2307. (W 41)

CENTRAL ELECTRICITY AUTHORITY
London Division

SHIFT CHARGE ENGINEER
WEST HAM POWER STATION

CANDIDATES should have had a sound technical training in Electrical and Mechanical Engineering with qualifications entitling to Corporate Membership of the I.E.E. of I.Mech.E. Practical experience in operation and maintenance of modern generating plant is necessary. Character and ability to deal with Staff problems is important. Salary and conditions of service in accordance with N.J.B. Agreement, Schedule A, Class H, Grade 7=£882 per annum inclusive of London Allowance.

Applications, quoting vacancy No. 55/1020, may be made on form obtainable from Divisional Secretary, Central Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received not later than 31 Dec., 1955. (W 237)

CENTRAL ELECTRICITY AUTHORITY

South Western Division

ASSISTANT SHIFT CHARGE ENGINEER required at Newton Abbot Power Station.

Superannuation Scheme. Salary, N.J.B. Class F, Grade 9, £675/£720.

Applicants should have had sound technical training and practical operating experience in a modern power station.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 31 Dec., 1955. (W 217)

CENTRAL ELECTRICITY AUTHORITY

Midlands Division

FOURTH ASSISTANT ENGINEER is required in the Protective Gear Section of the Technical Department. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 6, commencing in range £600/£725, ultimately rising to £785 per annum.

A University Degree, Higher National Certificate or equivalent qualification is desirable. Some knowledge of protective gear is required, and preferably experience with a switchgear manufacturer.

Apply, quoting Vacancy No. 153MD, on Form A.E.6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 31 Dec., 1955. (W 151)

COUNTY BOROUGH OF CROYDON

ELECTRICAL ENGINEERING STAFF

APPLICATIONS are invited for the following appointments:

(*a*) STREET LIGHTING ENGINEER. Commencing salary according to experience, progressing by annual increments of up to £70, to a maximum of £1,030 per annum.

(*b*) ELECTRICAL ENGINEERING ASSISTANT. Commencing salary according to qualifications, progressing by annual increments of up to £50, to a maximum of £805 per annum.

For particulars and application form write to: Borough Engineer, Town Hall, Croydon.

Applications to be returned to the Borough Engineer not later than Tuesday, 3 Jan., 1956. (W 135)

CENTRAL ELECTRICITY AUTHORITY

Yorkshire Division

require a STATION CHEMIST at Blackburn Meadows Power Station, Sheffield.

Salary £840/£900 per annum, Class H, Grade 7, N.J.B. Agreement.

Applicants should hold the Higher National Certificate in Chemistry and preferably have had previous power station experience.

Application forms obtainable from Divisional Secretary (Establishments), Central Electricity House, St. Mary's Rd, Leeds, 7, to be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
(W 244)

TECHNICAL INSTRUCTOR

(Electrical)

required by the Federal Government of Nigeria for two tours of 18 to 24 months or 3 tours of 10 to 12 months either (i) with prospect of permanency or (ii) on contract with resettlement grant of £100/£150 a year. Salary scale (including inducement addition) for (i) £750 rising to £1,284 a year, and for (ii) £810 rising to £1,386 a year. Commencing salary according to age and experience. Outfit allowance £60. Free passages for officer and wife. Assistance towards cost of children's passages. Grant up to £150 a year for maintenance of children remaining in U.K. Liberal leave on full salary. Candidates must have served a full apprenticeship and be experience practical tradesmen. They must hold a City and Guilds Final Certificate in Electrical Installation work (Course B) or equivalent qualification. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/41378/EE. (W 255)

CENTRAL ELECTRICITY AUTHORITY

North West, Merseyside and N. Wales Division

VACANCY NO. E.315/465/T.—SHIFT CHARGE ENGINEER, Dolgarrog Hydro-Electric Generating Station. Salary £555/£600 (A.7). Experience in the operation of hydro-electric generating plant would be an advantage.

Applications to Divisional Secretary, Central Electricity House, 825 Wilmslow Rd, Manchester 20, before 28 Dec. Quote Vacancy No. (W 214)

ASSISTANT ENGINEER required for Overhead Line Contracts, Inverness Area. Good salary plus subsistence if applicable. Apply: B. French Limited, Pike Mills, Green St, Kidderminster. (W 220)

ASSISTANT to Rural Electrification Officer required with knowledge of uses of Electricity in Agriculture; duties to include organisation of demonstration and educational work. Writing ability an advantage. Salary £840 x £30=£1,080 per annum. Apply giving full details of Electrical and Agricultural experience and qualifications to: Director and Secretary, British Electrical Development Association, 2 Savoy Hill, London, W.C.2. (W 211)

ASSISTANT ELECTRICAL ENGINEER wanted aged 25-35. Applicant should be conversant with plant lay-outs, schematic diagrams of connections, machine wiring and connection diagrams, ordering of electrical material and should have experience in draughtsmanship and at least National Certificate or equivalent in Electrical Engineering. Permanent position with pension scheme. Housing available.

Apply to Distington Engineering Company Limited, P.O. Box No. 8, Workington, Cumberland, giving particulars of experience and salary required. (W 149)

BRITISH Engine Boiler and Electrical Insurance Co., Ltd., 24 Fennel St, Manchester 4. The Company requires additional ELECTRICAL PLANT INSPECTORS in various districts in England and Scotland (Kilmarnock/Ayr). Permanent positions carrying progressive salary scale £600/£850 and non-contributory pension. Candidates age 26 to 30 years with apprenticeship in the manufacture or repair of electrical machinery, and who have gained the Higher National Certificate in Electrical Engineering or are graduates of the Institution of Electrical Engineers, are invited to apply in own handwriting stating age, qualifications and experience. (W 221)

BRITISH CELANESE LTD. require TWO ELECTRICAL DRAUGHTSMEN at their Spondon works. Applicants should have had experience preferably in the chemical or oil refinery industries and be fully conversant with the layout of high and low voltage switchgear, cable networks, power and lighting installations for chemical plants, and diagrams for automatic control and protective equipment. Good conditions are offered, and there is a contributory pension scheme and free life insurance. Please reply giving full details to the Appointments Officer, British Celanese Ltd., Spondon, Nr. Derby. (W 47)

THE SPENCER WIRE CO., LTD.,

Wakefield

invite applications for the position of Copper Wire Drawing Mill production Manager. The post is pensionable. Applications in confidence to be made to the Managing Director and should give age and very full details of experience and salary required. P.O. Box 14, Wakefield. (W 24p)

ELECTRICAL RESEARCH ASSOCIATION

Physicists, Electrical Engineers or Physical Chemists

are offered positions in the Physics department of the Association, as follows:

(*a*) PH.D. or graduate with good degree, interested in solid state physics, for fundamental study of electric breakdown; the effects of radiation on dielectrics; and related problems. Salary range £600/£1,000.

(*b*) Graduate with good degree and interest in research to study problems of electric breakdown. Salary range £600/£800.

(*c*) Graduate or H.N.C. to study deterioration of insulation. Salary range £450/£700.

Salaries within the ranges indicated will depend on age and qualifications and will carry annual increments and (after short probation) superannuation. All positions involve original research and give scope for independent work and increased responsibility limited only by the candidate's ability. Previous experience of the subjects is not essential.

The work, initially at Perivale, will move to new Laboratories at Leatherhead, Surrey, during 1956. Applications should be addressed to the Director, E.R.A., Wadsworth Rd, Perivale, Greenford, Middlesex. (W 204p)

CABLE JOINTING. Progressive firm in South has opening for DESIGN AND DEVELOPMENT ENGINEER with experience of modern methods of cable jointing. Write, in confidence, stating age, salary required and experience, to Managing Director —Box No. 5063, Electrical Times. (W 131)

CONTRACTS ENGINEER required to supervise several street lighting erection squads. Knowledge of electrical work essential, and must be prepared to travel in all parts of the country.—Box No. 5071, Electrical Times. (W 202)

DRAUGHTSMEN, for eventual promotion to Engineers. Must be experienced in power station electrical layout work in drawing office and on site. Location of work, London. Good salaries are offered. Five-day week. Non-contributory pension scheme. Upper age limit 35.—Box No. 5077 Electrical Times. (W 228)

DRAUGHTSMAN urgently required for work in Research Department of large industrial organisation in West London. Write or telephone Staff Officer, BICC Limited, 21 Bloomsbury St, W.C.1. MUSeum 1600. (W 249)

DRAUGHTSMAN wanted as Assistant to Engineer for preparation of electrical layouts for lighting, heating and power in industrial buildings. Preference would be given to one who has completed N.S. Apply Christy Bros. Limited, Chelmsford, Essex, with full particulars. (W 246)

NORTHERN IRELAND

Electrical Manufacturers require Senior Designer Draughtsmen with experience medium and large synchronous machines and induction motors for Industrial and Marine use, also draughtsmen experienced on similar size D.C. machines. Must be able to work with minimum of supervision. Five-day week in operation. State fully, experience, age and salary, to—Box No. 5069, Electrical Times. (W 183p)

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Wilton Works

ASSISTANT TECHNICAL OFFICERS

ELECTRICAL

Vacancies exist in the design organisation employed in the development of a rapidly expanding factory at Wilton Works, situated in the North Riding of Yorkshire four miles from the coastal town of Redcar.

Appointments are to permanent staff with Pension Fund, Profit Sharing Scheme, 5-day working week and excellent Company recreational facilities.

Candidates should have the appropriate National Certificate and previous design office experience.

Reasonable out of pocket expenses will be refunded to applicants invited for interview and after joining the staff, married men will receive a reasonable refund of removal (including travel) expenses; to assist in house purchase, facilities are available in approved cases for loans; in addition, legal charges may be advanced.

Write for application form to:

STAFF MANAGER,
IMPERIAL CHEMICAL INDUSTRIES LIMITED,
Wilton Works, Middlesbrough,
quoting advertisement reference ICI/X/270/p

(W 54p)

ELECTRICAL ENGINEERS. The opportunity occurs for an Electrical Engineer, experienced in all types of lighting and power installations in buildings, to take charge of old established London contracting business having finance available for expansion. First-class opportunity for progressive man. Applications will be treated in strict confidence.—Box No. 5073, Electrical Times. (W 223)

ELECTRICAL Wholesalers require an experienced ORDER OFFICE CLERK and a competent STOREMAN. Top rates of pay available to men with the right kind of experience, employment to commence Jan. Applications for either position to be made in writing to Managing Director, E. Dawson (Lamp Factors) Ltd., 10 Grays Inn Rd, London, W.C.1. (W 133)

ELECTRICAL ENGINEER with knowledge of testing and calibrating instruments required by large Oil Company for service in the Middle East. H.N.C. with experience in grading, testing and repair of relays and projection devices in power stations and on the associated E.H.T. and L.T. networks. Single men under 35 preferred. Pensionable service, paid home leave, salary according to experience. Write quoting No. 577 to Box No. 9452, c/o Charles Barker and Sons, Ltd., 31 Budge Row, London, E.C.3. (W 200)

JUNIOR TECHNICAL ASSISTANT required by London Chartered Patent Agents with a view to training for qualifying as a Patent Agent. Degree standard in electrical engineering desirable. Write giving details of age, experience, etc., to—Box No. 8813, c/o White's Ltd., 72/78 Fleet St, E.C.4. (W 76)

JUNIOR DESIGN DRAUGHTSMAN for automatic motor control gear. Good opportunity for young man, permanent position with five-day week—contributory pension scheme. Write giving full particulars of experience and salary. British Klockner Switchgear, Chertsey, Surrey. (W 30)

YOUNG ASSISTANT RESEARCH ENGINEER, with minimum qualification of H.N.C. in Physics or Electrical Engineering but preferably with science degree. Expanding Company—Interesting Research and Development work on Automatic Control Gear involving electronics and various electromagnetic control devices. Should preferably have served Student or Graduate Apprenticeship in Electrical industry. Apply giving details of salary required and previous experience to—Box No. 5011, Electrical Times. (W 193p)

GRADUATES in Maths, Physics or Engineering are required for research and development work in telecommunications. They will be offered opportunities for advance to senior executive appointments. Pension scheme. Applications which will be treated in the strictest confidence to ACTM, Southern United Telephone Cables Limited, Dagenham Dock, Essex. (W 97)

MIDLAND SILICONES LTD., an associate company of Albright and Wilson Ltd., require an ELECTRICAL ENGINEER or PHYSICIST to set up a small test section dealing with electrical measurements on silicones at their Barry, Glamorgan, factory. Qualifications must include at least H.N.C. and a good knowledge of electrical measurements. It is desirable that applicants shall have had several years' experience of dielectric testing. There is a generous non-contributory pension scheme. Candidates aged 23-28 years should apply to the Staff Officer, Ref. No. 264, Albright and Wilson Ltd., P.O. Box 3, Oldbury, Birmingham. (W 203)

OVERHEAD LINESMEN required by the Central Electricity Authority at STAYTHORPE TRANSMISSION SECTION. The work includes the overhaul and maintenance of existing 132,000 V lines and experience on 275,000 V lines will be an advantage. Previous experience of H.V. Steel Tower Lines essential.

Rate of pay 4s. 1d. per hour, 44-hour week. Terms and conditions of service in accordance with the National Joint Industrial Council Agreement. Applications in writing stating age and experience to Divisional Establishments Officer, Central Electricity Authority, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham. Please quote Vacancy No. 228/55/ET. (W 250)

PHYSICIST required with degree or H.N.C. for work on Magnetic Materials. Reply, stating age, qualifications and salary required to S.E.I. Ltd., Times Mill, Heywood. (W 132)

COURTAULDS LIMITED

require an additional ELECTRICAL ENGINEER for their Electrical Engineering Headquarters in Coventry.

The work will be with a section covering a wide range of activities from telecommunications to power consumption and commissioning tests on all types of industrial machinery and switchgear.

Applicants should have a University degree or H.N.C. in Electrical Engineering. An apprenticeship or some previous works experience will be an advantage.

Candidates should write for a detailed form of application to the Director of Personnel, Courtaulds Limited, 16 St. Martins-le-Grand, London, E.C.1, quoting reference number B.32. (W 227p)

ENGLISH ELECTRIC CO., LTD., STAFFORD

Applications are invited for the appointment of Chief Instrument Design Engineer, to take complete responsibility for the development and design of the Company's range of electrical indicating instruments.

The Company is prepared to consider engineers not necessarily with specialist electrical instrument experience provided they have experience in development and design for competitive manufacture of kindred mechanical or electro-mechanical devices.

Attractive unfurnished house is available, also early admission into the Company's Staff Pension Scheme.

Applications, which will be treated in confidence, should be addressed to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 1366C. (W 146p)

QUASI-ARC LIMITED, Bilston, has vacancies for TWO DEVELOPMENT ENGINEERS in its Welding Research Department. Applicants, who should possess H.N.C. in electrical and/or mechanical engineering, will join a highly qualified team of research workers engaged in the development of different methods of automatic arc welding. Attractive salaries commensurate with age and experience will be paid. Five-day week. Pension Fund. Apply in writing to the Company quoting reference CL.3. (W 248)

REPRESENTATIVE required by a leading Electrical Manufacturer to cover the counties of Oxon and Berks. Preference will be given to applicants with a knowledge of the Industry and a connection, in this area, with the Electrical Trade. Age, under 45 years. Remuneration by salary, commission and expenses. Car owner preferred. This vacancy offers considerable scope for an adaptable and enthusiastic salesman. Write to—Box No. 9474, c/o Charles Barker and Sons Ltd., 31 Budge Row, London, E.C.4. (W 216)

SALES ENGINEER required as personal assistant to Sales Director for Motor Control Gear company in N.E. London. Excellent prospects for applicant with good electrical training, personality and some experience. Duties include interviewing customers and preparation of tenders and sales literature. Write, stating age, experience and salary required.—Box No. 5067, Electrical Times. (W 177)

THE PARSONS AND MARINE ENGINEERING TURBINE RESEARCH AND DEVELOPMENT ASSOCIATION

has a vacancy for a

RESEARCH ENGINEER

with Engineering Degree or equivalent, for interesting and varied work on full scale trials of prototype steam machinery installations. Duties include the planning of trials, analysis of results and the writing of reports. Experience of steam plant operation is desirable but not essential. Salaries compare favourably with the Scientific Civil Service and there are superannuation and other benefits.

Applications in writing, stating age and experience, should be addressed to the Research Director, Parnetrada Research Station, Wallsend, Northumberland. (W 197p)

The Bristol Aeroplane Co., Ltd.

CHIEF ELECTRICAL AND GENERAL SERVICES ENGINEER

The Company invites applications for this Senior Executive appointment from Chartered Electrical or Mechanical Engineers with suitable experience and background. The position, which carries a substantial salary, involves the Management and organisation of a central Engineering Service department concerned with:

(*a*) The design, installation and operation of all major electrical supply and utilisation equipment;

(*b*) Steam-raising plant, and heating and ventilating facilities, throughout the Company's factories in the United Kingdom.

Applications will be treated in strict confidence and should be addressed to The Secretary, The Bristol Aeroplane Company Limited, Filton House, Bristol. (W 198p)

SECTION LEADER required for Electrical Section of Drawing Office. Essential to have wide experience of industrial electrical installations, preferably in connection with power distribution and lighting installations as applied to oil refinery and chemical plants, and must be capable of taking full responsibility for working the section. Five-day week, Pension Scheme. Write full particulars, age, qualifications, experience and salary expected to Foster Wheeler Limited, 3 Ixworth Place, London, S.W.3. (W 247)

SENIOR ELECTRICAL DRAUGHTSMAN required with experience in the field of general distribution and utilisation. Qualifications and experience should be to Graduate I.E.E. standard. The position can be regarded as permanent and progressive. The Company operates a non-contributory pension and insurance plan. Apply by letter to the Personnel Department, Kodak Ltd. (Factories), Wealdstone, Middlesex. (W 201)

SENIOR ELECTRICAL DESIGNER and DRAUGHTSMAN wanted; preferably to B.Sc. or H.N.S. standard and with some mechanical experience for electrical application to Machine Tools. Write stating age and full experience to: Employment Officer, Alfred Herbert Ltd., Coventry. (W 257)

SIMPLEX ELECTRIC CO., LTD., require at Creda Works, Blythe Bridge, A WATER HEATING ENGINEER and designer to be responsible for the development of all Creda Water Heating Products. This is a senior technical appointment which will carry an appropriate salary and status in the company. Qualified engineers and designers experienced in this field are invited to write, in confidence, giving details of career and salary expected, to the Managing Director, Simplex Electric Co., Ltd., Creda Works, Blythe Bridge, Stoke-on-Trent, North Staffs. (W 245)

SURVEYOR required, conversant with Surveying and Profiling of Overhead Line Routes. Good salary and subsistence. References required. Apply: B. French Limited, Pike Mills, Green St, Kidderminster, or 35 Haugh Rd, Inverness. (W 259)

TRACER (FEMALE) wanted for Electrical Engineering design office in central London. Preference given to girl used to making tracings of electrical diagrams who can, in addition, make simple drawings. Applicants should be between 20 and 30 years of age. Salary according to experience. 5-day week; superannuation scheme. All applications will be treated in the strictest confidence and should be addressed in writing to Personnel Dept., Unilever House, Blackfriars, London, E.C.4. (W 222)

THE Telegraph Construction and Maintenance Co., Ltd., cable manufacturers, have vacancies for TECHNICAL ASSISTANTS in their Design and Specification Dept.

Applicants should have knowledge of one or more of the following:

1. Design of H.F. telecommunication, power or lighting cables.
2. Manufacture of electric cables.
3. Cable specifications.
4. Testing of H.F. or communication cables.
5. Cable applications.

Applicants should preferably possess H.N.C. or equivalent qualifications but applications will be considered from persons with suitable experience. Write details to: Personnel Manager, Telcon Works, Greenwich, S.E.10. (W 256)

TRANSFORMER TEST ENGINEER to take charge of Test Department dealing with units up to 15 MVA. Also ASSISTANT TESTER for above Department. Write, giving details of qualifications, experience and approximate salary expected, to Technical Director, Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Surrey. (W 199)

WORKS MANAGER required for Motor Control Gear factory in N.E. London, with 200 employees. Excellent prospects for man with initiative and experience of modern planning methods, production and labour control. Good salary with pension and bonus scheme for applicant with suitable experience. Write to Managing Director—Box No. 5065, Electrical Times. (W 176)

WANTED

ALWAYS BUYING Scrap Mercury, aircraft plugs, contacts, wire, foil, and all waste materials containing precious metals. Prompt service and settlement. Samples tested free. Belgrave Buyers Ltd. (E.T.), 5 Belgrave Gardens, London, N.W.8. MAI 7513. (W 225)

250 KVA ALTERNATOR 400/3/50 0·8 p.f. 600 r.p.m. with Exciter, single or two bearing machine. Reply—Box No. 5075, Electrical Times. (W 224)

METALWORK. All types cabinets, chassis, racks, etc., to your own specification. Philpotts Metalworks Ltd., Chapman St, Loughborough. (W 192)

WANTED, for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. and H. Cooper Ltd., 176 Brady St, Bethnal Green, E.1. (W 1)

WANTED ROTARY CONVERTERS, any size.—Universal, 221 City Rd, London, E.C.1. (W 2)

PATENTS

THE Proprietors of British Patents Nos. 652,164 for "Improvements in and Relating to the Sparkless Interruption of Polyphase Circuits," 654,624 for "Devices for Determining the Contact Time of Periodically Actuated Contacts of Switching Devices," 657,842 for "Annular Iron Core Choking Coils for Heavy Current Moving Contact Current Converters," and 663,022 for "Arrangement for Determining the Contact Time of the Periodically Actuated Contacts of Switching Devices," desire to enter into negotiations with a firm or firms for the sale of the patents, or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2. (W 251)

THE Proprietors of British Patents Nos. 667458 for "Improvements in Float-Operated Electric Relays," 668042 for "Machine for Winding Small Closed Rings with Thin Wire," 671511 for "Improvements in or relating to Electrical Condensers," 674622 for "Electrically Heated Device for the Mechanical Ironing of Insulating Material on the Straight Parts of Windings and Coils of Electrical Machines and Apparatus," 676397 for "Protective device for Electrical Apparatus Operating in an Insulating Liquid," and 684223 for "An Improved Device for the Mechanical Ironing of Insulating Material on the Straight Portions of Windings and Coils of Electrical Machines and Apparatus," desire to enter into negotiations with a firm or firms for the sale of the patents or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London, W.C.2. (W 252)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service fully guaranteed. Edgware 5566 (4 lines).—Service Electric Co., Ltd., Stanmore, Middx. (W 3)

ARMATURE REWINDING service to the trade. Vacuums, Drills, Grinders, Hood Dryers, Dental Motors. Vacuum Cleaner and Drill Armatures replaced from stock 24-hour service. Every job guaranteed. All Vacuum Cleaner parts, hoses, bearings, etc., in stock for any make. Complete overhauls our specialty, Regam Electric Cleaner Service, 95/99 Park Lane, Leeds 1. (W 4)

GLASGOW. Old established firm of Electrical Engineers with commodious premises, centrally situated, and having excellent workshop accommodation are interested in carrying out installations and/or acting as Service Agents on behalf of manufacturers of industrial, commercial or domestic plant. Stocking facilities available.—Box No. 5039, Electrical Times. (W 51)

LET US SOLVE YOUR BREAKDOWN PROBLEMS, repairs speedily carried out by experts. Collection and Delivery by our own transport. A. T. Robinson, Electrical Power Engineers, The Green, Southall, Middx. Southall 3494/5/6. (W 5)

METAL SPINNING capacity always available. London's Leading Specialists in Metal Spinnings for the Trade. A.I.D. Approved. Martin-Golod Ltd., Maybury Grdns, High Rd, Willesden, N.W.10. Tel.: Willesden 3888. (W 206)

AGENCIES

EXPERIENCED AGENTS required covering Electricity Boards, all districts British Isles. One or two other Agencies not objected to. Give full particulars including remuneration expected.—Box No. 5047, Electrical Times. (W 96)

EXPERIENCED AGENT covering Kent, Surrey, Sussex, Hants, Berks, wants additional agency accessories or domestic appliances. Well established Electricity Boards, Wholesalers, Leading Contractors.—Box No. 5037, Electrical Times. (W 38)

MISCELLANEOUS

LEARN ELECTRICAL ENGINEERING the practical way. Our new self-study course includes equipment on which experimental work can be carried out. Also courses for all professional examinations. Free brochure from E.M.I. Institutes, Dept. E.T.57, London, W.4. (Associated with H.M.V.) (W 39)

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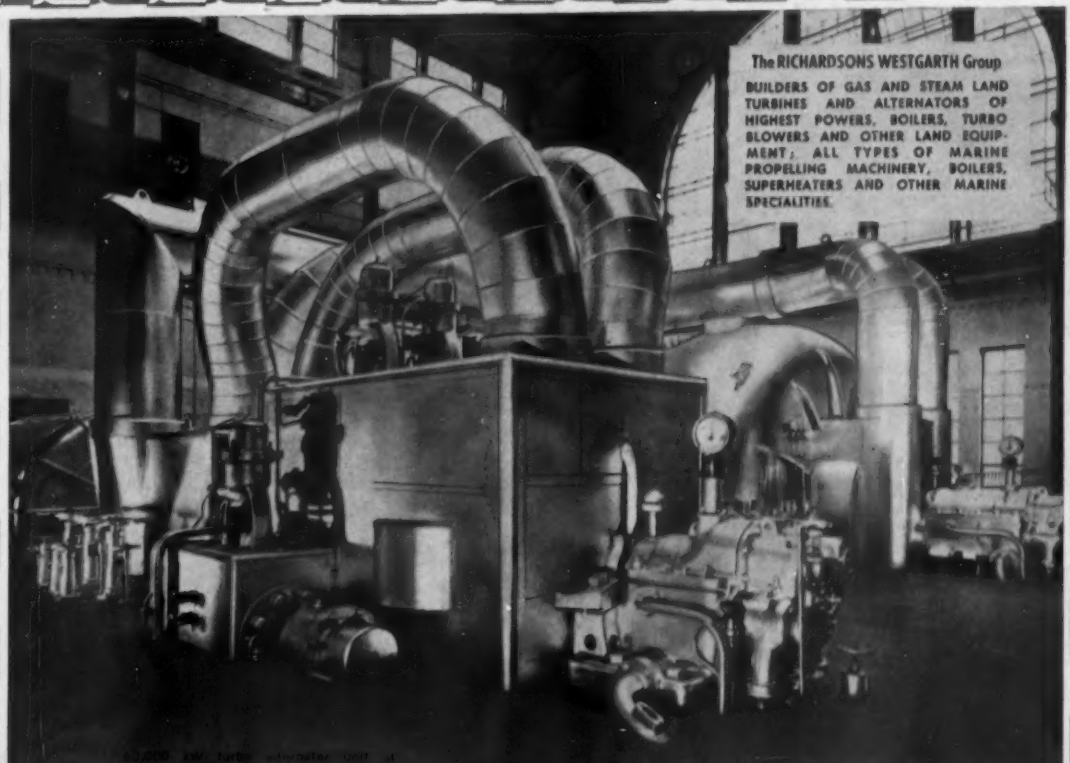

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BUILDERS OF GAS AND STEAM LAND TURBINES AND ALTERNATORS OF HIGHEST POWERS, BOILERS, TURBO BLOWERS AND OTHER LAND EQUIPMENT; ALL TYPES OF MARINE PROPELLING MACHINERY, BOILERS, SUPERHEATERS AND OTHER MARINE SPECIALITIES.

60,000 kW. turbo alternator unit at Portobello H.P. (Edinburgh) Power Station

Record Thermal Efficiency Achieved Again!

The high efficiency of Central Electricity Authority power stations during the year ending 31st March, 1955, has collectively accounted for a saving of over 750,000 tons of coal, valued at £2¾ million.

The leading station in the Authority's efficiency list for the country as a whole was Portobello H.P. (Edinburgh)—*for the second year in succession.*

The turbo alternator units, condensing plants and feed heating systems at this power station were built by Richardsons Westgarth (Hartlepool) Ltd. Each of the units has an output of 60,000 kW.

RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.

RW NEM GC

ASSOCIATED COMPANIES:-

THE NORTH EASTERN MARINE ENGINEERING COMPANY LTD.

GEORGE CLARK AND NORTH EASTERN MARINE (SUNDERLAND) LTD.

R.L.S.

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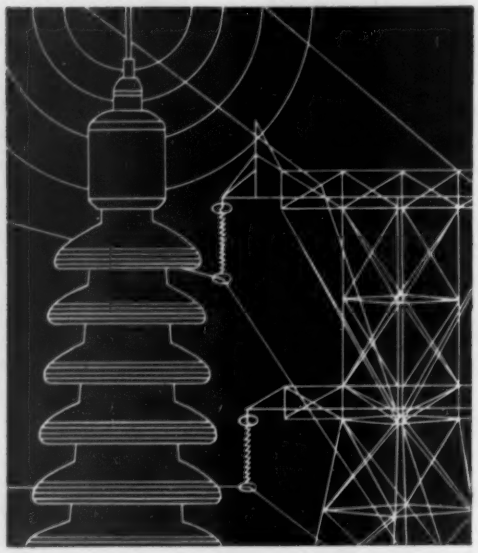

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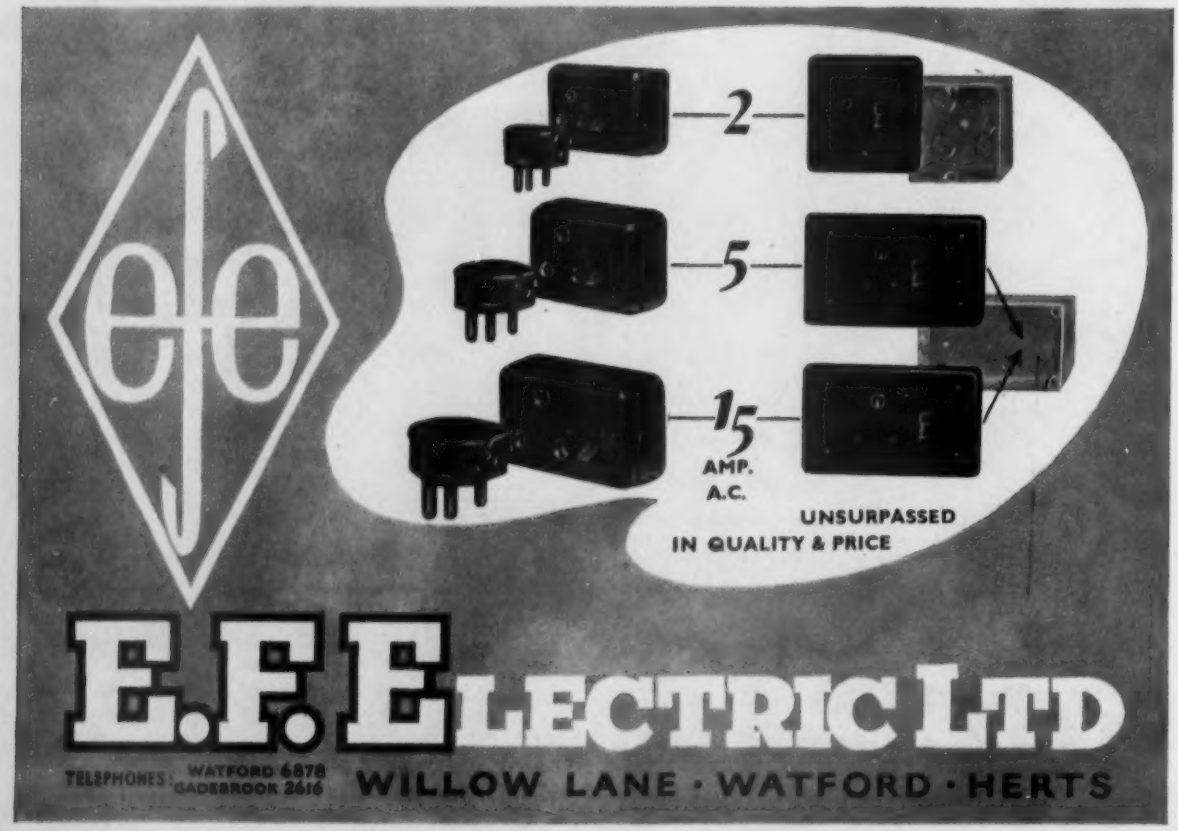

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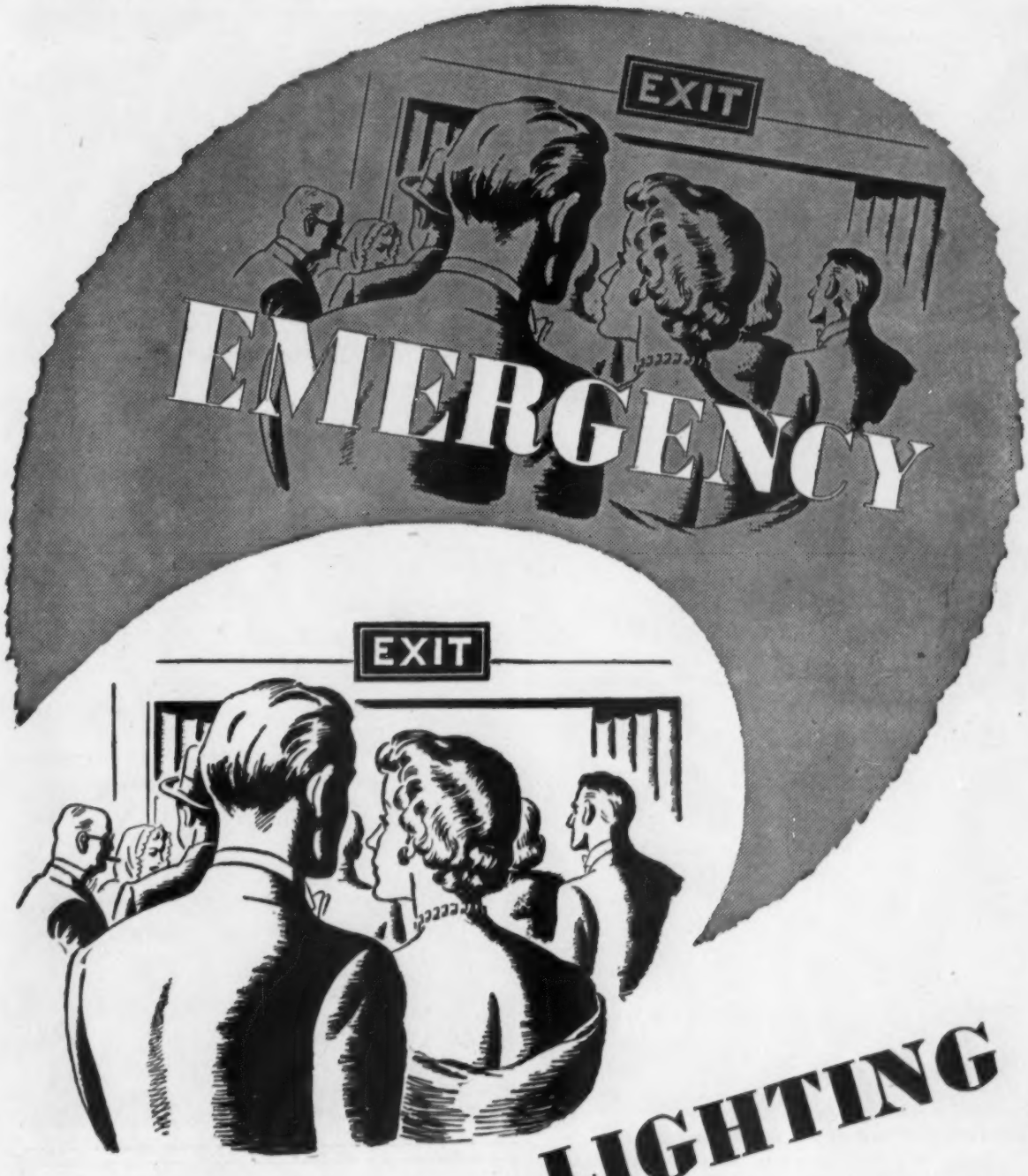

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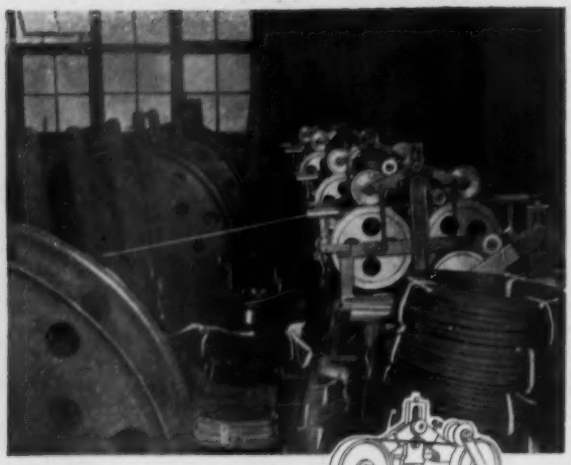

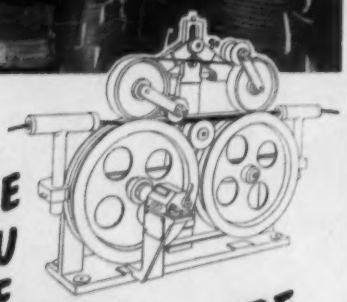

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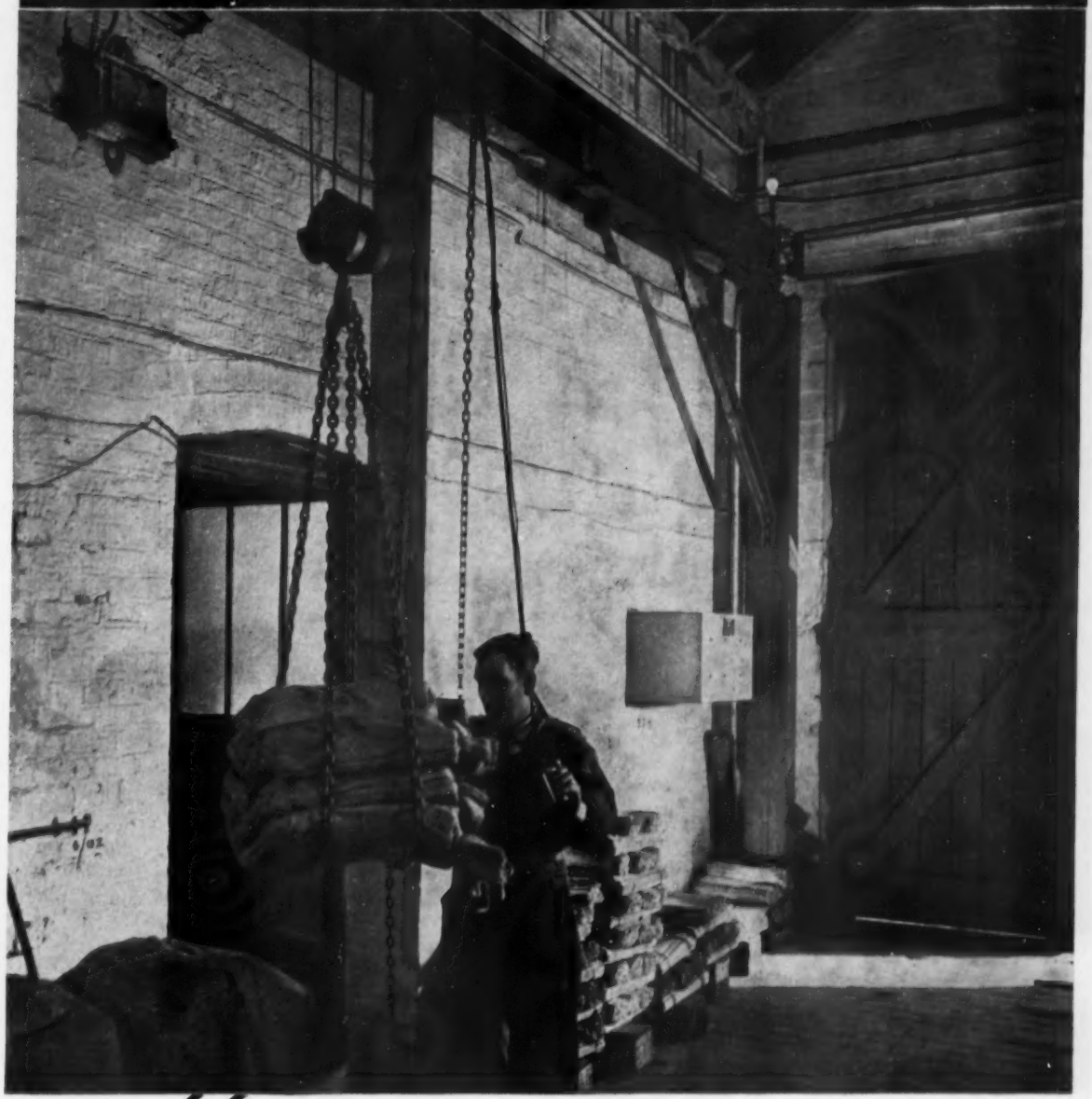

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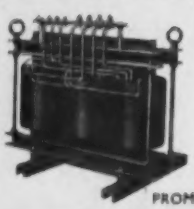

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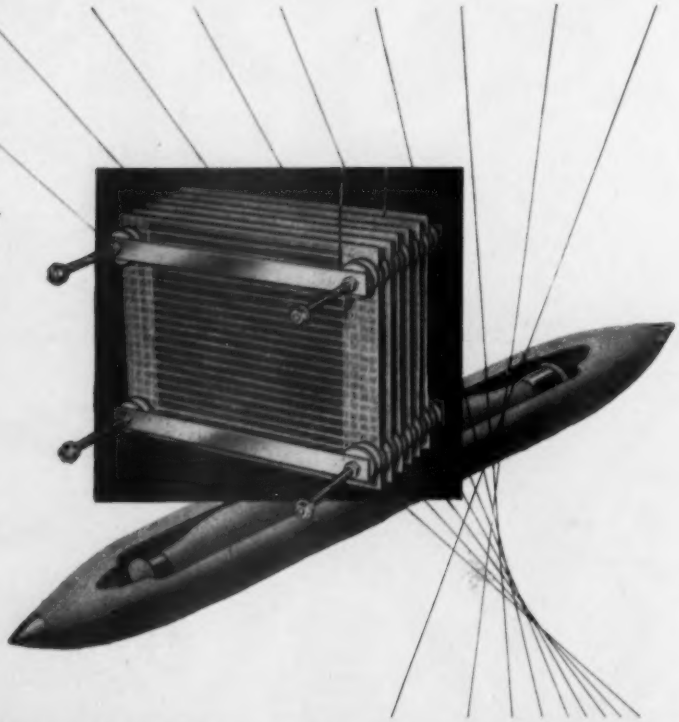

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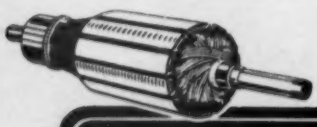

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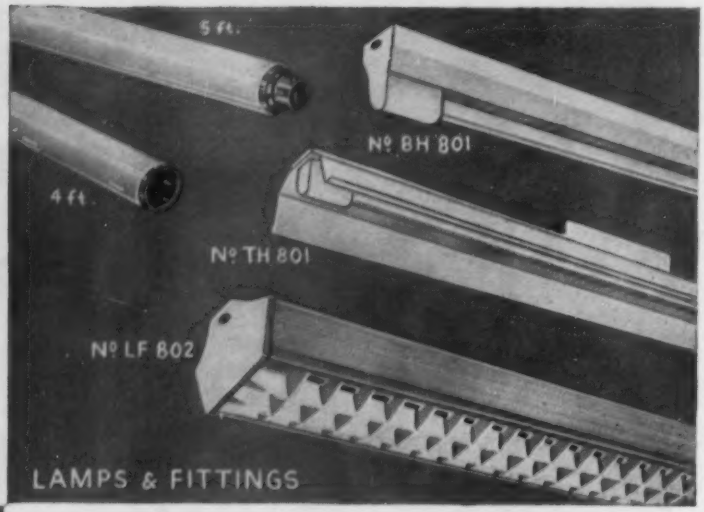

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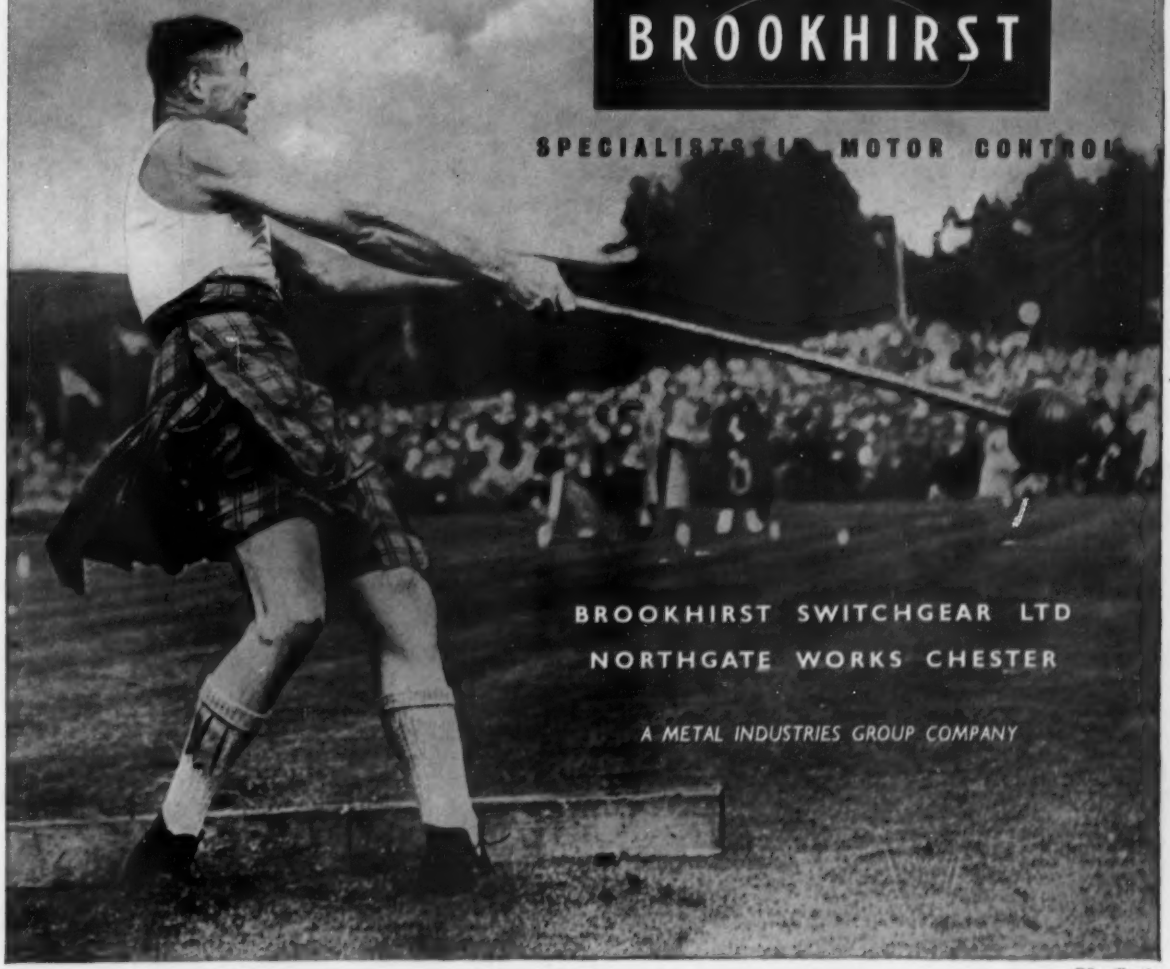

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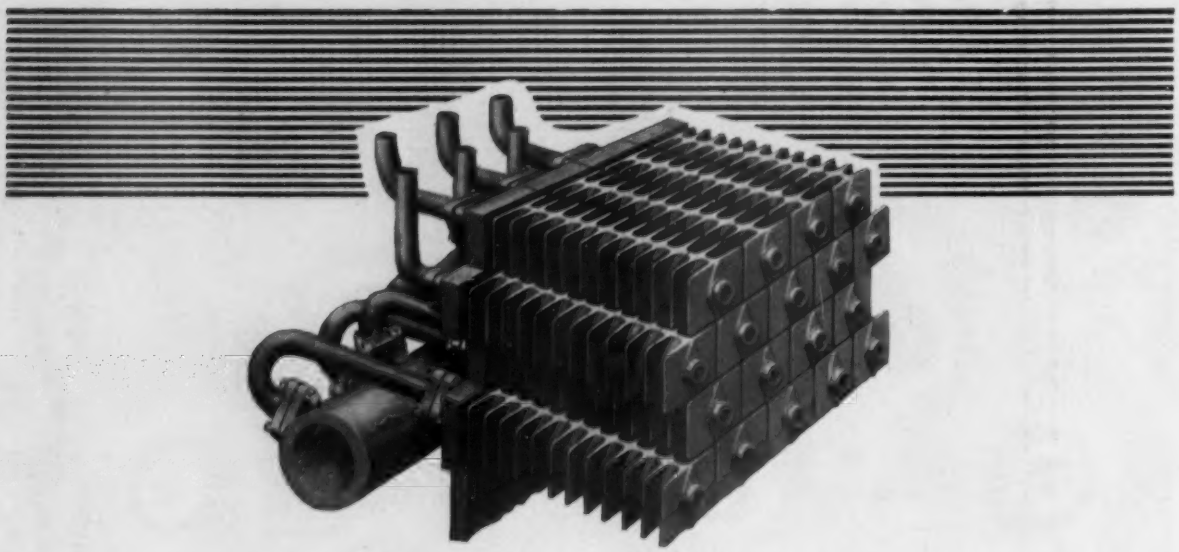

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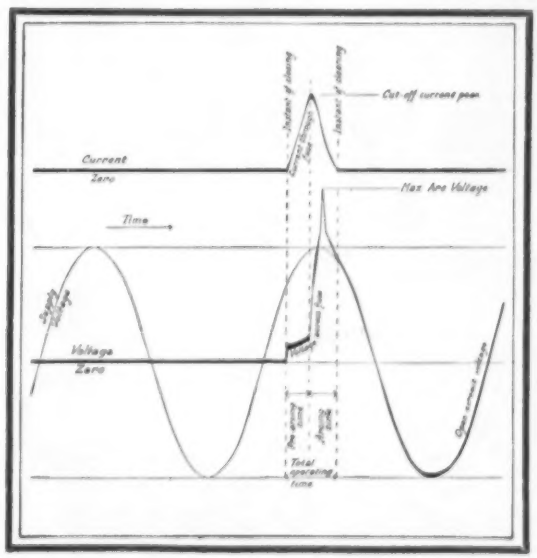

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